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Metals Review

January 1959

Evelyn G. Gardner
Miss A.S.M.
(See Article, p. 4)

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Evelyn G. Gardner—The Gal in A.S.M.'s Front Office

THE ONE person who probably has the most intimate knowledge of A.S.M. operations, functions, purposes, activities and history is Evelyn Genevieve Gardner, long-time secretary to the late W. H. Eisenman and now secretary to the Board of Trustees. It was 30 years ago last June that Evelyn, 17 years old and fresh out of high school and business school, joined her aunt on the A.S.M. staff. The aunt was Ursula Teslik, secretary to Mr. Eisenman; a little more than a year later when Miss Teslik became Mrs. Coleman, Evelyn stepped into her job. It was a large responsibility for one so young and inexperienced, but it was no time at all before she became her boss's indispensable "Girl Friday".

It was never an easy job. Mr. Eisenman, as everyone knows, was devoted to the American Society of Metals; he lived and thought and dreamed A.S.M.—and he became used to having his enthusiasm affect others. So it was that A.S.M. became the focal point of Evelyn's life. Hers was the kind of self-effacing dedicated service that goes on year after year, unrecognized, almost unnoticed. Without "Evie" it is doubtful that Mr. Eisenman could have contributed so much to the Society and the metallurgical profession; it was she who guided the tremendous inflow of correspondence over his desk, spotting the important, handling the minor—and many of the major—details with a sure intuition of his wishes, scheduling appointments, arranging travel, keeping his personal books, even in the later years seeing that medicines were administered and that every possible creature comfort was at hand.

A large part of Evelyn's life has been spent in travel, for she accompanied Mr. Eisenman on many rounds of chapter visits, to all of the Metal Shows, to Europe twice. The travel of course was rewarding, particularly the winters spent at the Eisenman home in Palm Springs, and her friendship with Mrs. Eisenman is a treasured thing. But pleasure and sightseeing were inevitably subordinate to business. She learned the penalty of travel on her very first trip when she accompanied Mr. Eisenman to California for the first Western Metal Congress and Exposition in 1929. Evelyn in her business training had mastered the stenotype and this new device then seemed an ideal means for recording the oral discussions at technical sessions. During this first trip to California therefore Evelyn spent her days dutifully recording the discussions and then stayed up until two o'clock each morning transcribing the results before her notes became cold—to say nothing of sandwiching in her important secretarial duties between times!

Evelyn still lives in the house in Lakewood, a Cleveland suburb, where she was born; her father died when she, the oldest of four children, was six. The other three are all married, and for many years Evelyn and her mother have shared their home with Evelyn's grandparents, great grandmother and an aunt. The great grandmother died at the age of 95, her grandmother just a few months ago at the age of 98—both active and vigorous women who left Evelyn a heritage of health, energy and stamina. She is devoted to her family, generous to a fault and never happier than when the large old house is full of relatives for family festivities.

When Mr. Eisenman died in May of last year one would have thought that Evelyn's world would come tumbling down. Not so—she faced this great blow with quiet courage and calm and the determination to carry on just as she knew "the Boss" would have wanted her to and just as she had in many another crisis in his and her personal and business careers.

The Board of Trustees, recognizing the tremendous importance of her knowledge of A.S.M. affairs has appointed her its secretary. Through her funnel all the important matters that now must come to the Board's attention. Her responsibility is also the minutes of long and frequent meetings—not only those of the Board itself but the staff meetings which must be interpreted for Board action. Characteristically she has a full travel schedule, and is now making arrangements to accompany vice-president Walter Crafts on an extended tour of A.S.M. chapters in the spring. She was also appointed secretary for the A.S.M. Foundation for Education and Research.

Evelyn now has no boss in the Headquarters building; she is responsible only to the Board of Trustees and is the vital link between policies set by the Board and their accomplishment by the A.S.M. staff.

Buehler Makes Second Contribution to the A.S.M. of Tomorrow

Following-up his unsolicited gift the $2000 to A.S.M. made in the Spring of 1957, Adolph Buehler, president of Buehler, Ltd., Evanston, Ill., again sent a voluntary contribution of a like amount to Society headquarters in December, 1958.

The intended use of the money was specified only in that it, like its predecessor, is to be put to work in advancing the A.S.M. of Tomorrow. Mr. Buehler's letter states:

> "Being conscious of the above project which was the dream of our departed Bill Eisenman, it is a great pity that he could not live to see the fruits of this advanced project for the A.S.M. of Tomorrow.
>
> Please accept my humble donation for $2000 for this project of our old friend, Bill Eisenman."

Adolph I. Buehler came to this country from Switzerland in 1922 and, after graduating from Optical College, Berlin, he joined Leitz, Inc., as a sales and service engineer for microscopes. He advanced rapidly in this field, opened a branch office in Chicago in 1929, and in 1936 established his own business in optical instruments and metallographic sample preparation equipment.

By 1954 Mr. Buehler had combined all his production and sales operations in one building in Evanston for his now-extensive line of metallurgical apparatus. Both his cataloging and his news publication, the *AB Metal Digest,* are outstanding examples of technical information and communications in the metals field.

Appreciation to Mr. Buehler has been extended by Dr. C. H. Lorig, president of the Society, in these words:

"Pete Ford has given me your fine letter of Dec. 17, and informed me of the generous check in the amount of $2000 for the A.S.M. of Tomorrow that Bill Eisenman envisaged. I wish that he were here with us today to more adequately express the appreciation of the Society for this wonderful interest that you have in your Society.

Until I can see you again and thank you personally, please accept this deep appreciation for your gift in behalf of the Board of Trustees of the American Society for Metals."

Young Speaks at Wilmington

At the National Officers Night meeting held late last season, members of the **Wilmington Chapter** heard G. M. Young, technical director, Aluminum Co. of Canada, Ltd., speak on "Light Alloys and Heavy Industry".

Mr. Young prefaced his talk with a few words about A.S.M.'s program for the future and showed the plans for the Society's new national headquarters building. He also mentioned some of the contributions that A.S.M. makes to industry, education and technological advancement. — **Reported by Liston Noble, Jr., for Wilmington.**

Western Metal Congress Features Papers Of Interest to Aircraft, Rocket, Missile, Satellite and Electronics Industries

PAPERS, PANELS AND FORUMS of extreme interest to the aircraft, rocket, missile, satellite and electronics industries will be featured at the 11th Western Metal Congress, Mar. 16-20, 1959, at the Ambassador Hotel in Los Angeles. Displays of newly developed metals, equipment and methods for these western industries will be displayed at the same time at the exhibits to be set up at the Pan-Pacific Auditorium and combined pavilions during the Western Metal Exposition.

Announcement of the two events was made by Ray T. Bayless, acting secretary A.S.M. While the American Society for Metals is the sponsor of the Congress and the Exposition, western sections of more than 25 national technical societies are cooperating.

Other groups holding technical sessions will be the American Welding Society, the Society for Nondestructive Testing, and the Metals Branch, Southern California Section, American Institute of Mining, Metallurgical and Petroleum Engineers.

Ted DuMond, A.S.M. coordinator of the Congress technical sessions, is organizing four half-day sessions on "Explosive or High-Velocity Forming" for the last two days of the Congress. Speakers for many of these sessions will be from Convair and Lockheed plants, where progress has been made in this rapid method of forming metal. Members of the San Fernando Valley Chapter A.S.M. will also participate.

An A.S.M. four-day program formulated by a committee of which Robert H. Gassner, supervisor, materials and process engineering, Douglas Aircraft Corp., is chairman, will include papers on Aircraft Power Plants, Solid Propellant Missile Airframes, and Liquid Propellant Missile Power Plants.

Panel discussions will be held on "Effects of Advances in Mill Practices on Material Characteristics", "Low-Alloy Steels" and "Lithium-Aluminum Alloys".

A session on "Rolling Technology" will include papers on Sandwich Rolling, Close Tolerance Rolling and Taper Rolling. An A.S.M. panel on "Improvements in Quality Control" is also scheduled.

Additional papers will cover Progress in Forging Technology; Steel Heat Treating—Carbon Control; Reduction of Warpage; Welding Problems Concerning High-Strength Steel Thin-Wall Pressure Vessels; Hydrospinning; Hydrogen Embrittlement of UHS Steels; Magnesium-Thorium Alloys; Titanium and Titanium Alloys; Stainless Steels; and High-Temperature Alloys.

Ted DuMond (Left), A.S.M. Coordinator for Technical Programs at the 11th Western Metal Congress, Is Shown With the Heads of Various Program Committees. Others are, from left: J. O. McCaldin, program chairman, Metals Branch, A.I.M.E.; Kermit Skeie, member of S.N.T.'s program committee; R. H. Gassner, program chairman A.S.M.; and R. J. Frick, program chairman A.S.M.

Ray T. Bayless (Left), Acting Secretary A.S.M., Confers With Members of Los Angeles Chapter on Plans for the 11th Western Metal Congress and Exposition. Others, from left: D. S. Clark, past national president A.S.M., R. H. Gassner, program chairman A.S.M.; and H. A. Curwen, vice-chairman

The American Welding Society program formulated by a committee headed by R. J. Frick, manager, electric welding sales, Linde Co., Los Angeles District, includes papers on the following timely subjects:

Welding Techniques of Low-Alloy High-Strength Tools in the Missile Industry; Welding of Thin-Gage Aluminum for the Aircraft Industry; Welding of High-Temperature Materials; Fusion Welding of Precipitation Hardening Steels; Problem Areas in the Heliarc Welding of a Highly Stressed Pressure Vessel; Weldability of Thorium-Magnesium Alloys; Quality Control of Spotwelding Shear Strength; Experimental Design in Welding; Fusion Welder, Continuous Recertification; and 42,200 Welds Per Second.

J. O. McCaldin, manager, chemistry department, materials research laboratory, semiconductor division, Hughes Aircraft Co., is chairman of the A.I.M.E. technical sessions. His program will cover: Materials for Thermo-Electric Power; Recent Advances in Solid State Physics; Radiation Effects on Materials; and Ultra-High-Temperature Use.

The program for the Society for Nondestructive Testing was still in a tentative stage when this article was written.

Canton-Massillon Gives Scholarship

Canton-Massillon Chairman G. Brainard Trumble Is Shown (Left) Presenting the $200 Louis A. Zeitz Scholarship Award to Donald J. Williams, Timken High School, While John A. Rinebolt, Chairman of the Metallurgical Advancement Committee, Looks On. The award was established by the Chapter in memory of L. A. Zeitz, an industrial engineer in the Canton Division of the East Ohio Gas Co., who served as secretary to the Chapter for many years. It is restricted to seniors intending to pursue general science or engineering studies. Mr. Williams has entered Ohio State University where he expects to major in mechanical engineering studies

Cites Advances in Aeronautical Research

Speaker: J. F. Victory
N.A.C.A.
(Now N.A.S.A.)

"Recent Significant Aeronautical Scientific Progress" was the title of a talk given by John F. Victory, N.A.C.A. (now N.A.S.A.) at a meeting of the **Philadelphia Chapter.**

The flight vehicles of the future will be concerned with many scientific problems, such as aerodynamic heating, guidance and materials to withstand enormous temperatures on reentry into the earth's atmosphere, but the basic components of space vehicles will be the same as those that were basic to the Wright brothers' first successful airplane of 1903. These components are the structure, the power plant and the control system. Just as the airplane must slow down to land so must the space vehicle decelerate to enter the earth's atmosphere and land its human occupants or cargo in safety.

The X-15 research airplane, often described as man's first venture into nearby space, is one of the results of N.A.C.A.'s interest in space research. It is the result of the cooperative effort of the N.A.C.A., the Air Force and the aircraft industry, and is designed to fly faster than one mile a second at altitudes above 100 miles.

For research on materials and structures for very high-speed airplanes, missiles and space craft, N.A.C.A. has put into operation a thermal structures tunnel at the Langley Aeronautical Laboratory. This tunnel has a 9 by 6 ft. section where large specimens may be studied in a supersonic air stream at temperatures up to 700° F. An advanced version of this facility for tests of large specimens at temperatures as high as 4000° at speeds more than five times the speed of sound is being designed.

N.A.C.A. materials research now centers largely on properties and behavior of materials under the severe conditions of re-entry into the earth's atmosphere in space flight. Properties of many alloys under conditions of transient heating, total heat capacities of a number of metals and nonmetallic substances and relative ablation rates for many materials heated to high temperatures have been determined.

For study of materials and structures of hypersonic airplanes, ballistic missiles and space craft which may encounter temperatures as high as 12,000° F. on return to the earth's atmosphere, the N.A.C.A. uses a variety of "hot-shot" research facilities. These include air jets heated to 5000° at speeds more than 3500 mph.; hot jets employing ethylene or rocket fuels ranging from 3500 to 8000°; and air jets heated by high intensity electric arcs capable of 12.000° at hypersonic speeds. The Langley Aeronautical Laboratory is designing another electric arc-jet which will exceed 20,000° to aid in this research.

Some scientists estimate that millions of meteors enter our atmosphere every day but nearly all of them burn up as they enter the earth's atmosphere. While this burning process, due to aerodynamic heating, is fortunate for residents of the earth, it is an equal obstacle to ballistic missiles and manned space craft reentering the atmosphere. Vehicle temperatures may climb more than 100° per sec. during the critical heating phase. If this phase lasts one minute, the outer skin of the vehicle could exceed 6000°.

Meet at NYU for Titanium Conference

Engineers From Government Agencies and the Titanium and Steel Industries Met at New York University in September for a Conference on the "Alloying, Processing and Heat Treatment of Titanium", Presented by the Metallurgical Engineering Department, College of Engineering, and Sponsored by Six Industrial Firms. Shown are, from left, back row: James R. Long, Harvey Aluminum Co.; Stuart Arnold, Watertown Arsenal; D. L. Day, Titanium Metals Corp.; and E. Bohenek, Titanium Metals Corp. In the front row, from left, are: A. V. Kinsey, Canadian Dept. of Mines; Thomas Perry, Republic Steel Corp.; J. Middendorp, Wright Air Development Center; and Harold Margolin, professor at New York University

Cleveland Hears President Lorig

A.S.M. President C. H. Lorig, Technical Director, Battelle Memorial Institute, Who Delivered His Talk on "Selection of Materials in This Changing World" Before a Meeting of the Cleveland Chapter, Is Shown With Keith J. Humberston, Chairman of the Chapter

Gives Talks on Steelmaking

M. Tennenbaum, Metallurgical Department, Inland Steel Co., Gave a Talk on "Developments in Steelmaking" at a Peoria Meeting. At the speaker's table were, from left: Ray H. Hays, chairman; Mr. Tennenbaum; and A. L. Jerome, technical chairman of the meeting

Describes Free Machining Steels

Leaders at a Meeting Held by Worcester Chapter Included, From Left: Nicholas P. Wakeen, Technical Chairman; Thomas B. Taylor, Bliss & Laughlin, Inc., Who Spoke on "Modern Free Machining Steels"; and W. J. Nartowt, 1957-58 Chapter Chairman, Who Presided

Speaks at New Haven

Russell F. Novy, Research Laboratory, Lindberg Engineering Co., Spoke on "Modern Heat Treating Equipment and Processes" at a Meeting Held in New Haven. Shown, from left: Lloyd E. Raymond, technical chairman; Mr. Novy; and Kenneth Tingley, chairman

Inspect Nonferrous Casting

Kenneth Herrick, Chief Process Engineer, Arwood Precision Casting Corp., Spoke on "Nonferrous Investment Casting" at a Meeting of New Haven Chapter. Shown are, from left: E. W. Lovering, technical chairman; Mr. Herrick; and K. Tingley, chairman

Speaks on Aluminum Products

Shown at a Meeting of Rhode Island Chapter Are, From Left: Clifford S. Ey, Chairman; Marshall C. Battey, Vice-Chairman; Donald J. Davidson, Program Chairman; and Robert Hamilton, Aluminum Co. of America, Who Spoke on "Aluminum Products and Their Manufacture"

Discusses Cold Extrusion of Steel

Robert W. Gardner, Senior Engineer, Research and Development Center, Verson Allsteel Press Co., Gave a Talk on "Materials and Techniques for Cold Extrusion of Steel" at Milwaukee. He was assisted by W. W. Wishart, metallurgical engineer at Verson. Shown, from left: S. L. Henry, chairman; Mr. Gardner; Mr. Wishart; and H. W. White, technical chairman.

Speaker: R. W. Gardner
Verson Allsteel Press Co.

Robert W. Gardner, senior engineer of the Research and Development Center, Verson Allsteel Press Co., discussed "Materials and Techniques for Cold Extrusion of Steel" at a meeting of the **Milwaukee Chapter.** He was assisted by W. W. Wishart, metallurgist for Verson.

Cold extrusion in the United States has been developed and used to the greatest degree as a forming process, dimensional size and finish being the criteria, with desired physical properties obtained through subsequent induced carbon heat treatment. This type of processing has been highly developed for civilian consumer products or goods. U. S. processing differs from the major portion of work done in Germany which makes use of work hardening during flow to obtain desired physical properties in the product.

Many of the advantages of cold extrusion lie in the field of economy. These include the use of low-cost hot rolled base materials, elimination of scrap, and saving in equipment cost, maintenance and labor due to the elimination of machining operations. Automation has been successfully applied to production and inspection of extruded parts. Mr. Gardner stressed that economic advantages of extrusion are obtained in many cases on items of only moderate production quantities.

In the process of cold extrusion the product finish is a direct result of the die finish, and in most cases is smoother than grinding, though not as smooth as a honed surface. Close dimensional tolerances are also achieved. An example was given of an intricate extruded part, a pinion gear in which tooth pitch dimension and profile are maintained within 0.005 in.

An important factor in the success of cold extrusion is tool life, which is dependent largely on tool design and on proper pretreatment and in some cases preshaping of the slug. In some cases coining is used to alter the size and shape of commercial rod or bar to fit the extruding die, and to produce final dimensional shapes on the base of the part which cannot be obtained by extrusion without excessive tool wear. Upsetting is used to produce a profiled slug which leaves voids in the die cavity. Collapse of such profiled slugs cushions the initial impact loading of the punch and permits higher ram velocities, and thus high production rates. Either of these preshaping operations may be followed by an anneal operation to produce a favorable microstructure for plastic flow, when high carbon or alloy steels are used for the product.

Proper surface preparation of the slug is important and consists of cleaning, descaling and the application of zinc phosphate coating lubricant. This lubricant is a very important factor as it must resist some heat in very high pressures, and will also travel with the surface flow of the metal.

Mr. Gardner's talk was accompanied by a short movie and a series of slides illustrating principles of extrusion die design for intricate shapes, and special applications which have been developed at Verson Allsteel Press Co. These included the use of punch guiding members which permit much higher penetration ratios than has heretofore been possible.— **Reported by J. W. Quick for Milwaukee Chapter.**

A.S.M. is the largest publisher of books for the metals industry in the world.

Metallographs Travel

Prizewinners in the 1957 A.S.M. Metallographic Exhibit held in conjunction with the World Metallurgical Congress in Chicago are currently on tour of several European countries. The exhibit was shown in Paris during the annual meeting of the Societe Francaise de Metallurgie on Oct. 20 to 25. It is also scheduled for showing before the British Institute of Metals during its spring meeting, Apr. 14 to 16, 1959, and before the Deutsche Gesellschaft fuer Metallkunde in Germany at its 1959 meeting.

The 1957 exhibit was of particular interest to Europeans because of the large number of entries received from overseas. These entries were largely encouraged by the conjunction of the Second World Metallurgical Congress with the annual National Metal Congress and Exposition in Chicago, Nov. 2 to 8, 1957.

All prizewinning entries in 13 classes had been circulated to A.S.M. chapters, universities and other interested groups in the U.S.A. during the winter of 1957-1958. Because of the bulk of the exhibit, the exhibit shipped to Europe consisted only of first-prize winners and "Best in Show".

Cites Importance of Foreign Ore Imports

Speaker: P. C. Paterson
Timken Roller Bearing Co.

Members of the **Canton-Massillon Chapter** heard a talk on "Strategic Importance of Foreign Ore Imports" by P. C. Paterson, service manager, Railway Division, Timken Roller Bearing Co.

Mr. Paterson's duties have taken him on several trips into South America and Labrador visiting various mining operations, part of which were the basis of his talk. Mr. Paterson's remarks were confined to the manganese and iron ore deposits at these locations.

The speaker was present in June 1958 when the mining and processing of the one millionth ton was completed at the manganese ore mining properties of ICOMI located in the Amazon jungle in the territory of Amapa, Brazil. He pointed out that Brazil is one of the largest producers of manganese. He has also made several trips into Brazil visiting some of the largest high-grade iron ore deposits in the world.

In reference to the Labrador deposits which he has visited, Mr. Paterson stated that from an economic standpoint the Lake Superior Region taconite ores are still a long way from competing with the high-grade Labrador ores.

The speaker supplemented his talk with numerous colored slides of the locations visited. — **Reported by G. Matthews for Canton-Massillon.**

Outlines Details of Russia Tour

J. W. Spretnak, Ohio State University, Spoke on "Soviet Metallurgical Education and Research". He is shown, right, with John Kary, technical chairman

Speaker: Joseph W. Spretnak

Ohio State University

"Soviet Metallurgical Education and Research" was the subject of a talk in **Detroit** by Joseph W. Spretnak, professor and research supervisor, metallurgical engineering department, Ohio State University.

Prof. Spretnak delivered a first-hand account, based on his experience as a member of an American metallurgical delegation which toured the Soviet Union in October 1957, tracing the education of a Russian student through the state-operated schools and industry and research institutes.

In the first ten years of primary and secondary schooling, the Russian student devotes 42% of his time to the sciences including math, physics, chemistry, astronomy, biology, etc. He starts at age 7, but attends six days a week and has short summer vacations. If he is not screened out by the comprehensive state exams at the 7th or 10th grades, he will become one of the 8 to 12% intellectually elite who are admitted to college. (In the U. S., 25% of college-age population is in college). There is a 50% chance that "he" is a woman and an even better chance that he speaks English (the *Journal of Metals*, printed in English, has 5000 subscribers in the U. S. and 10,000 subscribers in Soviet Russia).

Upon his admission to a state-operated engineering training or polytechnic institute he pays no tuition but is granted a stipend of about 400 rubles per month (equal to the wages of an unskilled Russian laborer). The 5 to 6 year curricula for obtaining an engineering diploma is designed to fulfill a specific need in USSR industry and is highly specialized. For example, one curriculum at Moscow Steel Institute includes only ferrous extractive metallurgy (i.e., blast furnace, open hearth, electrometallurgy and furnace automation).

An advanced degree, known as a "Kandidat Degree", necessitates an additional three years study and research, while a doctorate requires the publishing of a notable piece of research followed by a public defense of this thesis before all comers at a well-publicized meeting.

Upon graduation the top soviet student is given first choice of job placement and the poor student is relegated to a less desirable opportunity. A new graduate must remain three years in his first assignment; thereafter he is free to bargain for a new position.

In contrast with soviet industry where heavy production schedules require an engineer to work continually under pressure, the research institutes of the Academy of Science operate at a leisurely pace with little sense of urgency. This environment is highly conducive to creative work. Both graduate students and full-time research scientists are employed in these institutes, each of which is headed by a chairman. The chairs of the Academy of Science and professorships at the training institutes are held in high esteem and are among the best-paid positions in the Soviet Union.—**Reported by J. C. Holzwarth for Detroit.**

Defines Continuous Casting

Rufus Easton, Manager, Continuous Casting, Koppers Co., Who Spoke on "Continuous Casting" at a Meeting in Cincinnati, Is Shown, Left, Speaking to a Member

Speaker: Rufus Easton

Koppers Co.

Rufus Easton, manager, continuous casting, Koppers Co., spoke on "Continuous Casting" at a meeting in **Cincinnati.** He illustrated his talk with a 16-mm. sound movie and numerous 35-mm. slides.

Mr. Easton described the equipment used and precautions taken in producing steel slabs by the continuous casting process. The most important part of the cooling cycle, he pointed out, is not in the copper mold so much as in the spray towers, directly beneath the copper mold. The mold is water cooled, which solidifies the shell about the molten metal, but due to shrinkage, good contact cannot be maintained. Consequently, the length of the mold is limited to approximately 20 in. to get the cooling slab into the water spray tower where more efficient cooling can take place. The casting is started by using a dummy bar in the copper mold, which is sealed by using asbestos packing between the bar and the mold walls. The mold walls are lubricated with vegetable oil to prevent the mold from sticking to the casting.

The speed of casting is primarily controlled by the speed of cutting the slabs to desired lengths. This cutting is done with oxy-acetylene torches with powdered iron added to the O_2 stream. The cut-off is acomplished with one or two torches, depending on the size of the casting being cut, and may take up to 60 sec. to complete.

The greatest immediate advantage of the process is the approximately 10 to 15% higher yield of usable slabs, with a resulting usable slab rate of from 98 to 99% of the original metal poured. Another advantage is that the total time from liquid metal to finished product may be as little as three hours.—**Reported by R. L. Bockstiegel for Cincinnati.**

Toolsteels Topic at Muncie

Speaker: J. C. Hamaker, Jr.

Vanadium-Alloys Steel Co.

John C. Hamaker, Jr., manager of the research department, Vanadium-Alloys Co., gave a talk on "Toolsteels" at a meeting of **Muncie Chapter.**

Dr. Hamaker covered the basic general requirements of toolsteels and explained the new AISI toolsteel classifications. Dr. Hamaker's talk was illustrated with slides and he passed out copies of the new AISI classifications and a sheet on the comparison of the major types of toolsteels. — **Reported by John A. Buxton for Muncie.**

Meet Your Chapter Chairman

INLAND EMPIRE

GEORGE J. FEGAN was born in Iowa and after obtaining his degree in electrical engineering at Iowa State College joined the Elliot Co., Jeannette, Pa., as a field engineer. During the war the company loaned him to the Navy Dept. Bureau of Ships as a design engineer in the electrical section.

In 1951 he accepted a position as vacuum and electrical engineer with Pacific Northwest Alloys, Inc. He has now taken over the position of manager of quality control. He is a member of other technical societies and takes part in civic work in the Municipal League and is on the Lay Citizens Committee on education in the Spokane area. He has also been a scout master and councilor in Boy Scout work.

A favorite hobby is photography, and he likes the Pacific Northwest very much because of the excellent opportunities for water skiing, swimming, hunting and fishing. He and his family, son Danny 6, and daughters, Mickey 11, and Susan 15 years old, spend as much of their leisure time as possible at their cabin on near-by Hayden Lake.

TULSA

MARK MCKINLEY BOWMAN, JR., native of Johnson City, Tenn., graduated from the University of Houston with a B.S. degree in mechanical engineering and a M.S. degree in engineering. His vocational experience since graduation includes several years with the Hughes Tool Co., head of the physical testing laboratory at the University of Houston and physicist with the Naval Research Laboratory, Washington, D. C. He is now metallurgical engineer for Phillips Petroleum Co., Bartlesville, Okla.

Mr. Bowman has made contributions in the field of fracturing and fracture dynamics and is listed in American Men of Science. His original A.S.M. membership began with the Texas Chapter in 1943, and at Tulsa he has served as vice-chairman and on the executive committee. He is also a member of other technical societies, the Chamber of Commerce and Junior Chamber of Commerce.

An apiary is his hobby; the rest of his available time is divided between the Little Theatre Guild and hunting. He has one daughter.

DAYTON

WALTER J. RIDD is foreman of the manufacturing research laboratory at the Frigidaire Division, General Motors Corp. He has been a member of A.S.M. since 1941.

Born in Kentucky, he received his B.S. and M.S. degrees in chemical engineering from West Virginia University. He was previously in the metallurgy department of Armco Steel Corp. Mr. Ridd has been a key figure in Chapter affairs for many years, serving on the educational and publicity committees, as treasurer and yearbook chairman, secretary and vice-chairman and has been on the executive committee since 1954.

Spare-time activities include stamp collecting and mineralogy field trips with his two children.

KANSAS CITY

C. PATRICK KENYON, a native of Kansas City, is a charter member of his Chapter. He was on the first executive committee and has been chairman of the educational, nominating and entertainment committees.

After acquiring a B.S. degree in chemistry and metallurgy he worked for a time in oil fields, nitro-shooting of wells and police laboratory work. He is now chief metallographer, Sheffield Division, Armco Steel Corp. At the A.S.T.M. convention in Boston last year his color transparencies won first place, and at the Professional Photographers meeting in Chicago "best in class". He gives lectures on color photography and has numerous ribbons won in A.S.M. metallographic contests.

Mr. Kenyon is active in civic affairs as chairman of the Ways & Means Committee, Shawnee Mission Sertoma Club, and he and his wife attend the Linwood Presbyterian Church where he is a deacon. For relaxation he likes target pistol shooting.

PEORIA

RAYMOND H. HAYS, assistant metallurgist, Caterpillar Tractor Co., joined A.S.M. in 1941. He is chairman of the A.S.M. handbook subcommittee on "Carbon Steel Bars and Forgings". He is also a member of S.A.E. and A.I.M.E.

Born in Louisville, Ky., his B.S. and M.S. degrees in metallurgical engineering were obtained at the University of Kentucky. His first job after college was with Park Lumber Co., Pleasure Ridge Park, Ky., then with the Ingersoll Products Division of Borg-Warner Corp. in Chicago for three years before taking his present position.

Mr. Hays served overseas in the European theater about three years as a major in the Chemical Warfare Service. For recreation he and his wife enjoy boating.

JACKSONVILLE

STEPHEN M. BOWES, JR., born in Pensacola, obtained his B.S. degree in mechanical engineering at Georgia Institute of Technology. After graduation he joined the Army Ordnance Corps, and for a year was instructor at Aberdeen Ordnance School, then a platoon leader with the Second Infantry Division in Korea, where he received the Bronze Star for meritorious service during two campaigns. Upon completing his service he returned to Florida Machine and Foundry as sales engineer, and he is now plant engineer.

He was one of the directors during the Southern Metals Conference, 1956-1957, and he has served as chapter secretary and treasurer. He is also active in other technical societies.

Stephen is an ardent fly fisherman, enjoys swimming, but most of all boating with his family in his runabout "Ramblin' 'Reck 11". Stephen III is two years old and daughter Margaret is approaching her first birthday.

G. J. Fegan

R. H. Hays

C. P. Kenyon

M. M. Bowman, Jr.

W. J. Ridd

Presents

Woodside Lecture

at Detroit

W. Paul Eddy (Center), Sixteenth Woodside Memorial Lecturer, Is Shown Receiving The William Park Woodside Certificate From R. F. Thomson, Technical Chairman, While John Sheppard, Detroit Chapter Chairman, Looks On

Speaker: W. Paul Eddy
Pratt & Whitney Aircraft Div.
United Aircraft Corp.

W. Paul Eddy, chief of engineering operations, Pratt & Whitney Aircraft Division, United Aircraft Corp., delivered the 16th Annual William Park Woodside Lecture before members of the **Detroit Chapter.** The title of his talk was "The Aircraft Engine —a Proving Ground for New Materials".

Mr. Eddy outlined the problems confronting the mid-20th Century materials engineer in developing and building an aircraft engine. These included continuously improving creep and fatigue resistance of alloys, decreasing friction, reducing weight and lowering cost, at the same time utilizing abundant materials. He described how existing alloys have been applied to new jobs or how new alloys had to be developed to fulfill the steadily increasing demands of the gas turbine engine. Since weight saving is such a critical consideration in an aircraft engine, any part that is not highly stressed is poorly designed. Maximum output from all materials is a prime requirement.

In the hot parts of the engine, high-speed steel has supplanted 52100 steel bearings for greater resistance to deformation at operating temperatures. Nickel and cobalt-base superalloys, long the standard of jet engines, have been improved again and again to keep pace with the increasing temperature requirements. Now it appears that further big improvements in these alloys are unlikely and that a major breakthrough is needed in the development of molybdenum, tugnsten, tantalum, columbium or chromium-base ultra-high temperature materials.

Vacuum melting of alloys has become widely used, not because better materials can be produced, but because less poor quality material is made by this method. Substitution of low-alloy steel for stainless grades in the compressor rotor disk has actually reduced a serious corrosion problem—stress-corrosion cracking. New electroplates of nickel-cadmium have also been developed for improved corrosion resistance at moderately elevated temperatures.

Outstanding among developments has been the adaptation and utilization of titanium in the aircraft engine. Here, vacuum melting, or preferably double vacuum melting, is necessary to gain the maximum in properties. Welding must be carried on in closely controlled inert atmosphere, and forming of some grades of alloys must be performed at elevated temperatures. Now, however, the working, welding, fabrication and machining characteristics have been developed to a point where, with rigorous quality control, a uniformly satisfactory product can be produced. Although the cost of developing titanium for this application was more than $100 million, its performance has been more than rewarding. In one compressor section alone it saves 443 lb. over the ferrous alloys it replaced.

Mr. Eddy concluded by stating that a pound of weight saved in an engine for a commercial airliner is worth $40 to $93 in providing lower fuel consumption, greater range, higher speed or greater pay load. In military combat aircraft the value of a pound of weight saved is immeasurable.—**Reported by J. C. Holzwarth for Detroit Chapter.**

25-Year Members Honored at Milwaukee

At the Recognition Night Meeting of the Milwaukee Chapter, Members of 25 Years or Over Were Honored. Present were, from left: Victor A. Aschenbrener, Chain Belt Co; John F. Schaefer, Globe Union, Inc.; Carl E. Swartz, National Trustee, Who Presented the Certificates; Edgar L. Harris, Chain Belt Co.; Soren Sorenson, Twin Disc Clutch Co.; Wilson Trueblood, Leeds & Northrup Co.; Austin R. Townsend, Wheelock Lovejoy Co., Inc.; and Carl J. Zilch, Bucyrus-Erie Co. Also honored were W. R. Bloxdorf, Macwhyte Co., H. K. Ihrig, Allis Chalmers Mfg. Co.; M. A. Scheil, A. O. Smith Corp., and W. O. Smyth, Wehr Steel Co. Dr. Swartz also presented a talk entitled "Continuous Casting Processes"

JOHN A. MAHONEY, JR., formerly with Reeves Pulley Co., is now sales engineer for Pangborn Corp., with headquarters at Jenkintown, Pa.

♦ ♦ ♦

DONALD E. SWAN has been appointed sales manager of Hoskins Manufacturing Co., Detroit, and will direct sales and service activities throughout the country. GEORGE A. FINUCAN succeeds him as manager of the Chicago-Aurora district office.

♦ ♦ ♦

WALTER R. KEITH has been appointed to the sales force of the Riverside-Alloy Metal Div., H. K. Porter Co., with headquarters at the New York office.

♦ ♦ ♦

RALPH C. SHIRING has been elected president of Picker-X-Ray Corp.'s Waite Manufacturing Division in Cleveland. He succeeds EDWIN C. GOLDFIELD who has retired.

♦ ♦ ♦

JOHN W. PETERSON is now field engineer at Norton Co.'s Philadelphia district office.

♦ ♦ ♦

Aircar Co., Lancaster, Ohio, has announced several promotions resulting from its expansion program. ELMER LEHMKUHL is now sales manager, responsible for marketing and sales in the Eastern Division, MARTIN BOYER is sales promotion and advertising manager, DURWARD B. VAUGHT has been assigned field representative in Virginia, Kentucky and southern West Virginia and other southern states.

♦ ♦ ♦

CHARLES ERIC HO, formerly with Esso Standard Oil Co., is now assistant manager of market and economic analysis for Climax Molybdenum Co.

♦ ♦ ♦

Handy and Harmon has appointed E. EARLE TIETZ manager of marketing, and ROBERT E. BURKE field sales manager. CLARK P. ZITZMANN was named New York district manager and WILLIAM K. HONAN industrial products manager.

♦ ♦ ♦

J. T. SABOL has been appointed district manager, Inductotherm Corp., Cleveland.

Reviews Steel Industry of Russia

Dennis J. Carney, Division Superintendent, Steel Production, Duquesne Works, U. S. Steel Corp., Spoke on the "Steel Industry and Education in Russia" at a Meeting of Canton-Massillon. Shown, from left: G. P. Michalos, vice-chairman; Dr. Carney; and R. A. Bloom, technical chairman

Speaker: Dennis J. Carney
U. S. Steel Corp.

"The Steel Industry and Education in Russia" was the subject of a talk by Dennis J. Carney, division superintendent, steel production, Duquesne Works, U. S. Steel Corp., at a meeting held recently by the **Canton-Massillon Chapter.**

Dr. Carney toured Russia with a group of ten Americans late in 1957 as a part of the American-Soviet metallurgical exchange arranged by the Moscow Steel Institute and New York University.

Dr. Carney stressed these points:

1. The Russians locate their steel plants near sources of ore rather than proximity to markets.

2. The Russians have increased the productive capacity of iron and steelmaking units through increased heat size and auxiliary equipment (i.e., charging machines, cranes, augmented furnace crews, greater supervision and utilization of latest advances in technology).

3. Top management is efficient and well trained.

4. Production is increased through workable incentive systems.

5. Education for steel metallurgists is thorough and specific.

A college education is available to any Russian high-school graduate between 18 and 35 years old who can pass the entrance examinations. Eighty-five percent of their college students receive government subsidies.

After the normal five-year college course, the best students are given their choice of the best jobs. The lowest ranking students usually unpack their bags in Siberia.—**Reported by R. R. Ernest for Canton-Massillon Chapter.**

National Trustee Speaks at Lehigh

Then National Trustee Carl E. Swartz Spoke on "Continuous Casting" at a Meeting of Lehigh Valley. Shown are, from left: J. F. Clark, chairman; Dr. Swartz; and Benjamin F. Shepherd, past national president and chief metallurgist, Ingersoll Rand, technical chairman of the meeting

Lorig Presents Charter

C. H. Lorig, President A.S.M. and Technical Director, Battelle Memorial Institute, Is Shown, Left, Presenting the Charter of the Southeast Ohio Chapter to Chairman A. F. Sprankle at a Recent Meeting

Speaker: C. H. Lorig

Battelle Memorial Institute

Over 50 members and guests were present at the first technical meeting of the newly organized **Southeast Ohio Chapter,** designated as "National Officers Night".

A. F. Sprankle, chairman, presided and accepted the Chapter's charter, which was presented by Clarence H. Lorig, then president-elect A.S.M. and technical director, Battelle Memorial Institute. Dr. Lorig stressed the responsibility of the Chapter in serving the people associated in the expanding metal industry in Southeast Ohio.

The technical session consisted of a talk by Dr. Lorig on "Selection of Materials Today". Designers, metallurgists and producers of a given device must coordinate their work when selecting material for new uses. Perfect material is seldom available so the designer must compromise and select the material best suited on the basis of cost, performance and availability. It is advantageous for the designer to consult with the metallurgist in the early stages. Quite frequently some of the difficult specifications can be avoided by proper design.

The designer may hamper the metallurgist by specifying unnecessary chemical composition for materials. It is important for a designer to know when the chemical composition is important and when only mechanical, thermal or other properties should be specified.

In many cases, there is a gap between the physical properties of test specimens and the actual properties of a structural part in service. A material which is weaker in a test specimen may actually be stronger in service because other factors such as ductility, shock resistance, thermal stability and corrosion resistance affect the life of material in actual service. Improved testing procedures and methods of evaluations are needed to determine how well materials will stand up in actual service.

In many new uses, including jet planes and missiles, temporary or transitory properties are important. Thus, in missiles, the useful life of some part may be measured in seconds. These temporary properties may be quite different from properties obtained by ordinary physical testing.

Extremely high-cost materials are frequently less expensive for a given use. Materials which have a higher initial cost may more than pay for themselves because they permit greater pay load or last longer. The ultimate cost is of primary importance in selecting any material not only for commercial use but also for military purposes. Cost is paramount in military items although it must be measured on the basis of providing the best weapon system at the lowest over-all cost. The determining factor in a cold war or even in a hot war may well be the best use of the country's resources.

With the increasing complexity of modern equipment, reliability of the individual components is becoming more and more important, as the failure of any one part may cause failure to the entire machine.—**Reported by H. W. Rathman for Southeast Ohio.**

Talks on Specialty Tubing

W. D. Manly, Left, Program Chairman, Is Shown With A. M. Bounds, Chief Metallurgist, Superior Tube Co., at a Meeting of the Oak Ridge Chapter. Mr. Bounds talked on "What's Special About Specialty Tubing"

Speaker: A. M. Bounds

Superior Tube Co.

Members at a meeting of the **Oak Ridge Chapter** heard a talk entitled "What's Special About Specialty Tubing" presented by A. M. Bounds, chief metallurgist, Superior Tube Co.

Mr. Bounds gave a brief history of the development of pipe and tubing. The art of making pipe is quite ancient, as evidenced by the fact that copper pipe was used in Egypt about 3600 B.C. The forerunner of present tubing, however, did not evolve until the discovery of gunpowder created a demand for gun barrels. Production of modern tubing by welding was not done until the 19th Century. Finally, seamless piercing methods were developed in Germany around 1900.

Modern processes of making tubing were next discussed. Although cold forming is used to make thin-walled welded small-diameter tubing, most tubing is produced by a piercing and drawing process. In the cold drawing version of this process, a plug or fixed mandrel is used. Tubes of less than one-half inch diameter are seldom produced by this method since the maximum reduction per pass is about 35%. In the fixed rod method, the tube and the hardened mandrel are both drawn through the die. Reductions of 45-60% per pass may be made in this way. Removal of the tube from the mandrel is accomplished by a light roll which causes reversal of stresses and an expansion of the tube away from the mandrel. Plug drawing or sinking must then be used to smooth the waviness caused by the expansion.

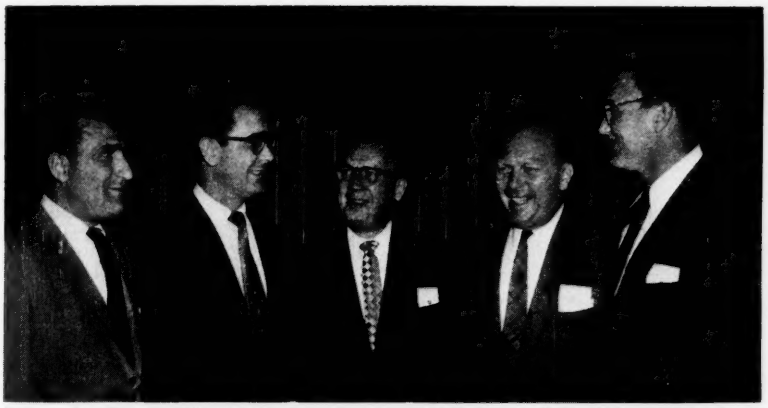
Extrusion has only recently been used to produce tubing, from hard metals and alloys, and then only in special cases because of the higher costs involved.

Mr. Bounds described items which make specialty tubing special. Such tubing is made from all metals and alloys, in any size, with special surface finishes and dimensions, and with special mechanical properties. The wall thicknesses may range from 1 to more than 80% of the diameter. Special heat treatments may require special furnace atmospheres. Some small sizes of tubing may require as many as 15 anneals during processing. In addition to all of the above, special tests and analyses of the finished tubing are often required.—**Reported by P. L. Rittenhouse for Oak Ridge.**

CHAPTER MEETING CALENDAR

Albuquerque	**Feb. 19**			Ladies Night
Baltimore	**Feb. 16**	Engineers Club		Radio-Isotopes in Industry
Birmingham	**Feb. 3**			Ladies Night
Boston	**Feb. 6**	M.I.T. Faculty Club	**J H. Hollomon**	Metals as Materials
Carolinas	**Feb. 4**		**Howard Patin**	Electron Finishing
Chicago-Western	**Feb. 16**	Old Spinning Wheel	**D. W. Gates**	Rockets and Space Ships—Their Development and Metallurgical Problems
Cleveland	**Feb. 2**	Engineering Society	**Panel**	Gears
Columbia Basin	**Feb. 10**		**W. R. Hibbard, Jr.**	Russian Metallurgy
Columbus	**Feb. 4**	Battelle Memorial Institute	**R. H. Heyer**	Evaluation Test for Sheet Materials
Dayton	**Feb. 11**	Engineers Club	**R. M. Evans**	Ladies Night
Delaware Valley	**Feb.**		**Social**	Valentine Party
Detroit	**Feb. 9**		**C. H. Lorig**	National Officers Night
Eastern New York	**Feb.**	Panetta's Menands		Patents in Metallurgy
Golden Gate	**Feb. 2**		**Paul Kirk**	Criminology
Hartford	**Feb. 10**	Indian Hill Country Club	**S. G. Fletcher**	Dimensional Change in Toolsteel
Indianapolis	**Feb. 16**		**W. S. Wagner**	Plastic Working of Metals
Kansas City	**Feb. 18**	Golden Ox		
Lehigh Valley	**Feb. 6**	Hotel Traylor	**D. J. Carney**	Pneumatic Steelmaking
Louisville	**Feb. 3**	White Cottage	**J. D. Graham**	Fundamentals of Radio-Isotopes
Mahoning Valley	**Feb. 14**		**Social**	Valentine Dance
Manitoba	**Feb. 12**	Marlborough Hotel	**Social**	Valentine Dance
Milwaukee	**Feb. 17**	Serbian Hall	**R. D. Manning**	Ultra-High-Strength Steels
Montreal	**Feb. 2**		**R. G. Robertson**	
Muncie	**Feb. 10**		**W. H. Steurer**	Guided Missiles
New Jersey	**Feb. 16**		**E. Wilson**	Metal Powder Slip Casting
New York	**Feb. 13**	Naval Shipyard	**Social**	Annual Dinner Dance
North Texas	**Feb. 5**		**W. R. Hibbard, Jr.**	Russian Challenge in Physical Metallurgy
Northwestern Pennsylvania	**Feb. 12**		**C. J. Comstock**	Industrial Applications of Powder Metallurgy
Notre Dame	**Feb. 11**		**D. K. Priest**	Stress Corrosion
Oak Ridge	**Feb. 19**	K of C Hall	**M. A. Scheil**	National Officers Night
Ontario	**Feb. 6**	Prince George Hotel	**J. Burk**	National Officers Night
Penn State	**Feb. 10**		**R. H. Aborn**	Recent Advances in Metallurgical Research
Philadelphia	**Feb. 27**	Engineers Club	**G. F. Sullivan**	Russian Bid for Leadership in Technology
Philadelphia—Jr. Section	**Feb. 4**	Engineers Club		Ladies Night
Purdue	**Feb. 17**		**L. A. Yerkovich**	High-Temperature Compression Behavior of Metals
Rhode Island	**Feb. 4**			Selection of Materials in This Changing World
Richmond	**Feb. 11**	Holloway House	**R. R. Freeman**	Molybdenum and Its Alloys
Rochester	**Feb. 9**	Manger-Seneca Hotel	**W. H. Steurer**	Rockets and Space Ships
Rockford	**Feb. 21**	Elks Club		Ladies Night
St. Louis	**Feb. 19**	Ruggeri's Restaurant	**G. F. Kappelt**	Are High-Temperature Materials Needed for Space Flight?
Saginaw Valley	**Feb. 10**	High-Life Inn	**C. H. Lorig**	Selection of Materials in This Changing World
Santa Clara Valley	**Feb.**		**Sherby**	European Developments in Metallurgy
Southeast Ohio	**Feb. 5**		**G. A. Roberts**	Toolsteels
Springfield	**Feb. 10**		**E. J. Lell**	Hard Facing Materials and Techniques
Texas	**Feb. 3**	Engineers Club	**H. E. Boyer**	Application of Newer Metallurgical Knowledge to Heat Treatment Properties of Steel
Toledo	**Feb. 12**	Maumee River Yacht Club	**J. D. Graham**	Field Failures
Tri-City	**Feb. 10**		**C. A. Turner**	High-Speed Heating of Metals Using Gas
Tulsa	**Feb. 3**	Alvin Hotel	**C. E. Stoops**	Industrial Uses of Radio-Isotopes
Utah	**Feb. 18**	Panorama Inn	**M. A. Cook**	Geological Chronometry
Washington	**Feb. 9**	Dodge Hotel	**W. A. Johnson**	Burgess Memorial Lecture
West Michigan	**Feb. 16**	Schnitzelbank	**R. S. McCrea**	St. Lawrence Seaway
Wilmington	**Feb. 11**	Sammy Green's	**Eric Morgan**	Nonstrain Aging Metal
Worcester	**Feb. 11**	Hickory House	**W. H. Moore**	Metallurgy of Cast Iron in Terms of Service Applications
York	**Feb. 11**	York	**R. B. Oliver**	Nondestructive Testing

Describes Metals for Memory Circuits



John A. Kurtz, Physicist, Cryogenics Department, International Business Machines Corp., Presented a Talk on "Metals in Memory and Computing Circuits" at a Meeting in New York. Shown are, from left: Robert Misshula, technical chairman; Mr. Kurtz; Frank Malone, Chapter chairman; Walter Stadtler, past chairman; and Ludwig Anselmini, the program chairman

Speaker: John A. Kurtz
International Business Machines Corp.

A talk on "Metals in Memory and Computing Circuits" was given at a meeting of **New York Chapter** by John A. Kurtz, Research Laboratory, International Business Machines Corp.

Mr. Kurtz reviewed the physics of superconductors. He discussed how the existence of metals with zero resistivity at low temperature makes possible the storing of persistent currents in rings of superconducting metals. These currents can be stopped by applying a magnetic field of strength equal to or greater than the critical field of the superconducting metal to switch the metal to the normal (or resistive) state. This critical field can be due to an external magnetic field, the field due to the current in the superconductor, or a combination of these. The Meissner effect (i.e., the exclusion of magnetic flux from a superconductor), was also covered. The existence of the intermediate state, a fibrous mixture of normal and superconducting domains, led to a discussion of the nonideal behavior of superconductors.

The second part of the talk was devoted to the use of superconductors in circuit components. The cryotron, a length of superconducting wire of medium critical field around which is wrapped a coil of superconducting wire of large critical field, was discussed. It was shown how the core of the cryotron can be switched from the superconducting to the normal state by applying a magnetic field from the coil. After telling how bistable devices are important in computers where a binary scale (zero or one) is used, a Buck-type flip-flop was described to show how the destruction of superconductivity by a magnetic field can be used to make a practical bistable circuit for computers.

The Crowe trapped flux memory was described. This device stores persistent currents in either of two possible directions by making use of both zero resistivity and exclusion of flux from a superconductor. Its behavior was analyzed and it was shown how information could be read into and out of the device.

The last part of the talk touched on the problems experienced with metals used in superconducting circuit components. The main difficulty is the fabrication of a metal which can be switched from the superconducting to the normal state without going into the intermediate state. This necessitates the use of very high purity metals with no defects. The difficulty experienced in vacuum evaporation of metals was also discussed.

The talk was concluded with a discussion of the advantages the compact superconducting computers will have over the bulky present day computers.—**Reported by E. J. Mullarkey for New York.**

Stresses Vacuum Melted Alloy Quality

William Dyrkacz, Allegheny Ludlum Steel Corp., Presented a Talk on "Quality Aspects of Vacuum Melted Alloys" at a Meeting of the Eastern New York Chapter. Present were, from left: Mrs. C. B. Craver, treasurer; Mr. Dyrkacz; J. H. Westbrook, chairman; and G. W. Reese, the vice-chairman

Speaker: William Dyrkacz
Allegheny Ludlum Steel Corp.

William Dyrkacz, Allegheny Ludlum Steel Corp., spoke on "Quality Aspects of Vacuum Melted Alloys" at a meeting of **Eastern New York Chapter.**

The vacuum melting industry has achieved a major production status. The 1957 figures for ingot pounds cast include 20 million for induction vacuum, 50 million for consumable electrode vacuum arc and 50 million for vacuum degassing. The alloys being produced include bearing materials, low-alloy steels, stainless steels and high-temperature materials.

Whereas in air melting, possible sources of contamination are the atmosphere, slag and crucible, none of these are present in consumable electrode vacuum arc melting, and only the crucible is present in vacuum induction melting. Another advantage of melting in vacuum is the close control of alloy additions such as titanium, aluminum, boron and zirconium.

Improvements in mechanical properties are possible if the mechanical properties are sensitive to chemical consistency or segregation. The higher cost of vacuum melting processes can be tolerated if the improved properties and quality are especially important. The speaker showed a film illustrating the consumable electrode vacuum arc melting technique. —**Reported by Louis Ianniello for Eastern New York.**

Santa Clara Hears Talk On Mechanical Properties Of High-Strength Steels

Speaker: Victor F. Zackay

Ford Motor Co.

Members of **Santa Clara Valley Chapter** heard Victor F. Zackay, supervisor, physical metallurgy section, Ford Motor Co., speak on "Mechanical Properties of Deformed Metastable Austenitic Ultra High Strength Steels". The talk was based upon a recently completed study by Duane Schmatz and Dr. Zackay on a new hardening technique first suggested by the Dutch metallurgists, Lips and VanZuilen.

The strength level of high-alloy steel demanded by industry has steadily increased to where present methods of producing high-strength steels appear inadequate. Steels which were designated for use at 180,000 psi. ten years ago are now heat treated for applications at strength levels of 260,000 psi. This increase in strength is accomplished generally by lowering the tempering temperature. Ductility and impact values formerly unacceptable are now specified. The standards of acceptance presently based on ductility and impact values cannot be sacrificed much further without encountering the brittleness usually associated with ceramic bodies.

An entirely different approach is that described several years ago by Lips and VanZuilen in that a 33% increase in yield strength over that reached by conventional heat treatments can be obtained by the deformation of metastable austenitic alloy steels and subsequent transformation to martensite or bainite. Preliminary efforts of the Ford workers, as well as those of other laboratories, indicated that the large improvements noted by the Dutch workers could not be substantiated when deforming the austenite just above the martensite transformation temperature by using conventional equipment as the Dutch studies had inferred. A process for achieving large deformations with conventional steelworking equipment was developed over a period of several years and the results were described.

The critical amount of deformation required for a significant increase in mechanical properties is of the order of 25% reduction in area. The first 25% deformation is highly effective while greater amounts of deformation are diminishingly beneficial. Deformations as high as 75% did, however, continue to improve the mechanical properties. The "bay" area, or region between the pearlite and bainite transformation bands, is convenient for accomplishing large amounts of deformation without the isothermal decomposition products. Lesser degrees of deformation may be obtained at other temperatures, although time then becomes a critical variable.

Substantial increases in ultimate tensile strength and elongation were noted at low tempering temperatures. Ultimate tensile strengths in excess of 400,000 psi. with excellent ductility were obtained on highly deformed medium carbon alloy steels. Consistent with the increases in ultimate tensile strength, the hardness of the deformed material was substantially increased over that of the undeformed material. An increase in hardness of 2 to 4 Rockwell C units was observed for material deformed in excess of 25%. The yield strength was also increased by deformation although more scatter in the results was evident at low tempering temperatures.

Higher tempering temperatures decreased the ultimate tensile strength of the steels rapidly while increasing the yield strength at a lesser rate. Tempering temperatures in the range of 500 to 600° F. appeared to be the optimum for the steels employed in this study. At the optimum tempering temperature, yield-to-tensile strength ratios were over 0.9. Higher tempering temperatures also were effective in reducing scatter in elongation data, and in considerably improving the ductility as measured by reduction of area. An optimum carbon content of 0.40% was established for the particular processing technique employed. This steel exhibited the highest yield strength with good ductiltiy for all the carbon contents investigated (0.28 to 0.52%).

Several suggestions were advanced for the mechanisms operative in this new hardening process. Decreased martensitic grain size, residual stress, increased dislocation density and very fine carbide precipitation were considered possible contributing factors. **—Reported by C. O. Matthews for Santa Clara Valley.**

Talks in York on Vacuum Pouring

Shown at a Meeting of York Chapter Are, From Left: P. Strategos, Meeting Chairman; E. Vitcha, Chairman; J. Fields, Bethlehem Steel Co., Who Spoke on "Vacuum Pouring for Large Forging Production"; and N. Stengel

Speaker: Joseph Field

Bethlehem Steel Co.

Joseph Field, metallurgical supervisor, Bethlehem Steel Co., talked on "Vacuum Pouring for Large Forging Production" at a meeting of **York Chapter.** With the aid of slides and a film, Mr. Field explained the process of vacuum pouring used at Bethlehem and pointed out the improved properties of a vacuum cast ingot over the conventional poured type. In common with many other products of the industrial world, the modern trend in the heavy forging industry has been toward a bigger and better product. With ever-increasing forging size and alloy content, it has become extremely difficult to obtain the necessary internal soundness in these large masses of steel by conventional practices.

Mr. Field stated that the vacuum pouring process enables the production of large ingots with lower hydrogen content, and this reduces sensitivity to flaking, which is one of the major causes of internal defects in large forgings. An improvement in tensile ductility and cleanliness is also recognized.

The advantages of vacuum pouring were first determined at Bethlehem on a seven-ton development or pilot unit, which gave an indication of benefits to be derived and production units were subsequently installed.

Present facilites at Bethlehem, in addition to the seven-ton unit, include two 250-ton production units, and the results obtained on these units, with the advantages and limitations of the process, were discussed by Mr. Field. Vacuum pouring represents one of the most important advances in the history of the heavy forging industry and may be the answer to many of its inherent problems.**—Reported by N. Stengel for York Chapter.**

Discusses High-Temperature Alloys

E. E. Reynolds, Allegheny Ludlum Steel Corp., Presented a Talk on "Alloys for High-Temperature Applications" at Indianapolis. Shown are, from left: Charles C. Patton, vice-chairman; Dr. Reynolds; Arnold W. Nelson, Allegheny Ludlum Steel Corp.; and Carl E. Weber, Chapter chairman

Speaker: E. E. Reynolds
Allegheny Ludlum Steel Corp.

Edward E. Reynolds, chief research metallurgist, high-temperature and valve steel research, Allegheny Ludlum Steel Corp., presented a talk on "Alloys for High Temperature Applications" at **Indianapolis.**

Dr. Reynolds' talk covered recent developments in high-temperature alloys, particularly those of interest to the aircraft industry, new methods of testing materials and new processing methods.

Some of the more recent alloys are of the precipitation hardening and cold worked austenitic stainless types. The properties of high-strength 5% chromium-type steels and of new iron, nickel and cobalt-base superalloys were discussed. Of the latter, AF 71 (Fe-Mn-Cr), D979 (Fe-Ni-Cr) and V-36 (Co-Ni-Cr) are outstanding. Most of these alloys have been developed in the last ten years to meet jet and missile age demands.

Tests developed for these high-temperature alloys include the thermal shock test, in which the material is heated to a very high temperature rapidly and cooled rapidly, the extremes of temperature being continued until failure; the high-speed tensile test, in which a combination of high heat and speeds, such as 120° per sec. loaded at 50% mn. until failure, is used; and the stress rupture versus time test for high heating rates such as 100° per sec. These tests are particularly suited for material for short-lived applications.

Most of the new alloys are made or can only be made by a vacuum melting process, including the induction melting, consumable electrode melting and vacuum degassing processes. These steels are superior to those produced by other methods and most suitable for use in the jet and missile applications because of their cleanliness, low gas content, hot workability, mechanical properties (no segregation), ultrasonic soundness and lower costs.—**Reported by Dorothy Holbrook for Indianapolis.**

Talks on High-Temperature Brazing and Soldering

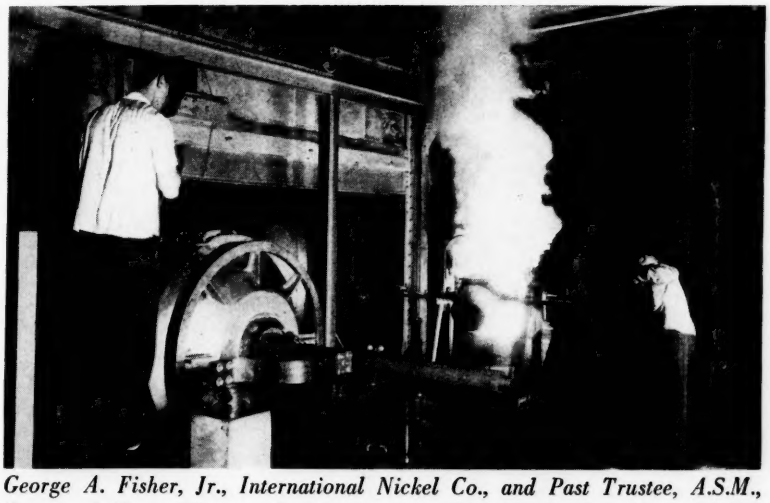
Speaker: Karl M. Weigert
Curtiss-Wright Corp.

Karl M. Weigert, research metallurgist, Curtiss-Wright Corp., talked on "High-Temperature Brazing and Soldering" at a meeting of **York.**

Dr. Weigert spoke on joining of metals by filler metals. At present, industry is particularly interested in joining metals at about 1000 or 2000° F. Nickel, silver, gold and palladium-base alloys are used for these difficult-to-join alloys. The advantages and shortcomings can be understood only by going a little deeper into metallugical studies and into the metal-joining mechanism. The American Welding Society has arbitrarily defined soldering as a process of joining metals by means of filler metals below 800° F., and brazing as all joining processes above that temperature. Thirty years ago there were only two types of filler metals —the so-called "soft" solders and the "hard" brazing alloys of 50/50 copper-zinc composition. The silver-copper-zinc alloys that formed strong joints at 1300-1400° F. appeared about 1930. For many years the strength of metal joints was studied as a function of the clearance and physical properties of the parent metals, with little regard to the metallurgical properties of the bonding alloys which were called solders or brazing alloys indiscriminately, or by the noncommittal name of "filler metals". The properties of these alloys are given as "tentative" in specifications, with no mention of any minimum strength requirements as is common practice in welding rod specifications.

Dr. Weigert discussed the properties and application of various precious metal "filler metals" and the nickel-base alloys used for high-temperature brazing. The old classification of low-temperature soldering and high-temperature brazing does not describe the properties of filler metal joints adequately, and he pointed out how the old words could be given a new and better meaning.—**Reported by N. Stengel for York Chapter.**

Plant Tour Features Electric Furnaces



George A. Fisher, Jr., International Nickel Co., and Past Trustee, A.S.M., Gave a Talk on "Recent Developments in Ductile Cast Irons" at a Meeting of Notre Dame Chapter. The Dodge Manufacturing Corp. was host to the meeting and prior to the talk a tour was taken through the plant. Shown is the pouring of a heat of ductile iron from an electric furnace

Quarterly preprint list

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The following papers will be preprinted for distribution to members of the American Society for Metals upon request. Order the papers by their numbers.

The six papers herewith listed represent the 1959 first quarterly preprinting of papers accepted by the Transactions Committee for inclusion in the annual volume of the Transactions of the Society. A brief abstract of each paper is included.

125. The Flow, Fracture and Twinning of Commercially Pure Vanadium, by W. R. Clough, Supervisor, Metals Research and Development, Connecticut Aircraft Nuclear Engine Laboratory, United Aircraft Corp., Middletown, Conn., and A. S. Pavlovic, Research Physicist, Metals Research Laboratories, Electro Metallurgical Co., Niagara Falls, N. Y.

Commercially pure calcium-reduced vanadium, which was analyzed and found to contain as little as 0.036 wt. % carbon, exhibits a second phase that has been successfully extracted and identified as V_2C. Oxides and nitrides could not be found, even though maximum weight percentages of 0.07 and 0.083 oxygen and nitrogen, respectively, were determined.

Tensile tests, made in the temperature range from 200 to −196° C., exhibited a five-fold increase in yield strength, a three-fold increase in tensile strength, and a ductile to brittle transition. There is a corresponding decrease of ductility with decreasing temperature. The variation of yield stress with temperature has been well correlated by use of the postulations of Fisher, based on the Cottrell and Bilby theory of yielding.

As determined by V-notch Charpy tests, energy and fracture-appearance transition temperature are exceptionally well defined and occurred concurrently. Both the [100] and the [110] are active cleavage habit planes, and both families of planes can be operative in the cleavage of a single crystal. Cleavage steps are originated when the path of brittle fracture crosses a low-angle twist boundary, a high-angle boundary, and when particles of the second phase, V_2C are intersected. During cleavage failure, microcracks were found to form in advance of the propagating principal crack.

Mechanical twins were formed by impact loading at test temperatures of −78° C. and lower. Twins occur on [112] planes, apparently only within one or two grains of a cleaved surface.

126. A Study of the Relationship Between State of Aging and Notch-Fatigue Performance of a High-Strength Aluminum Alloy, by G. W. Form, Assistant Professor, Dept. of Metallurgical Engineering, Case Institute of Technology, Cleveland.

The fatigue performance of notched specimens of a duralumin alloy (2014 alloy) was studied in relationship to state of aging. The tests were carried out in an axial loading type vibrator under a nominal stress of 28,500 psi at room temperature and −110° F. The results obtained suggest that the poor fatigue to tensile strength ratio of high-strength aluminum alloys is not invariably associated with overaging taking place during alternating loading.

127. The Effect of Uranium Hydride Distribution and Recrystallization on the Tensile Properties of Uranium, by H. R. Gardner and J. W. Riches, General Electric Co., Richland, Wash.

The effects of hydrogen concentration, beta uranium hydride formation and particle size, recrystallization and cooling rate from recrystallization temperature on the tensile properties of uranium were determined over a temperature range of −20 to 200° C. Significant effects on tensile properties were produced by each of these variables.

128. Effect of Interstitial Carbon Plus Nitrogen and Precipitation Reactions on the Properties of Austenitic Cr-Mn-C-N Steels, by C. M. Hsiao and E. J. Dulis, Crucible Steel Co. of America, Central Research Laboratory, Pittsburgh.

The effect of the interstitial elements carbon and nitrogen and precipitation reactions on the room and elevated-temperature mechanical properties of autenitic Cr-Mn-C-N stainless steels has been investigated. In the solution-treated condition, these steels may be maintained as solid solutions at room temperature. However, a state of supersaturation exists, and heating to elevated temperature (either by prior heat treatment or during service at elevated temperature) enables precipitation reactions to occur.

The strengthening effects of C and N on the room and elevated-temperature tensile properties were established for steels in the solution-treated condition. This strengthening is related to the lattice strain and to the valence effects of the interstitial solid solution of C and N.

Analysis of the effects of the interstitial solid-solution elements on creep-rupture properties is complicated by the influence of the factor time at temperature. During the relatively long-time exposures at the test temperatures, the interstitial elements form carbides and nitrides by precipitation reactions. The morphology and distribution of these phases have a marked effect on properties.

The effects of the following two types of precipitation reactions on the room and elevated-temperature properties have been investigated: (1) Grain-boundary reaction (characterized by the formation of lamellar nodules at grain boundaries), and (2) general precipitation (characterized by Widmanstatten structure). In general, it has been found that the grain boundary reaction is detrimental to the creep-rupture strength and the general precipitation is beneficial.

(Continued on p. 19)

Chicago Meeting Features Newer Metals

Donald J. McPherson, Armour Research Foundation, Presented a Talk on "Metallurgy of the Newer Metals" at Chicago. Shown are, from left: Elliot Nachtman, technical chairman; Dr. McPherson; and W. Wilson, chairman

Speaker: D. J. McPherson

Armour Research Foundation

Donald J. McPherson, manager, Metals Research Dept., Armour Research Foundation, spoke on the properties of many relatively scarce metals that should come into their own as tonnage materials in the near future in a talk on "Metallurgy of the Newer Metals" at **Chicago.**

Ten metals and their alloys were described individually with regard to their properties in relation to density, cost, heat resistance, high-temperature physical and special nuclear properties.

Tantalum, vanadium, chromium and zirconium, with their alloys, possess properties that place them in a favorable position to meet future nuclear demands. Others like columbium, molybdenum, beryllium and tungsten appear less likely to succeed as large tonnage metals. Hafnium and rhenium were described in detail, but are too scarce to rate much consideration.

The meeting was closed with an interesting and informative question and answer period.—**Reported by I. R. Wood for Chicago.**

Machinability Defined At St. Louis Meeting

Speaker: L. J. Nowikowski

Metcut Research Associates, Inc.

Leonard Nowikowski, Metcut Research Associates, Inc., spoke at **St. Louis** on "Machinability".

Defining machinability as the ease with which metal parts company in any machining operation, Mr. Nowikowski pointed out that the work material, machine tool and cutting tool are prime factors in the machining process. Improvement of the machining process and machinability requires analysis and understanding of the elements which enter into the process. Usual evaluations of machinability utilize tool life, surface quality of the work and power requirements as criteria.

Tool life testing as a measure of machinability is valuable because of its importance to the production shop. The speaker prefers the use of long-time tool life testing in determining the machining characteristics of any material rather than short-time tests, such as constant load testing and the use of radioactive tools. Long-time tool life testing provides information which can be readily applied to production shop operations. Short-time tool life testing can be used to classify materials generally as to relative machinability.

One very important aspect very often overlooked and frequently underrated in the evaluation of a material's machining characteristics is the close relationship between microstructure and machinability. Each steel has a range of machinability ratings as great as the range of microstructures which can be obtained with the particular composition of steel. Hardness test results cannot be used as an accurate indication of machinability. Steels with different microstructures, even though equivalent in hardness, will have greatly different machinability characteristics. The use of suitable thermal treatments to develop desirable microstructures can improve machinability and reduce machining costs.

Machinability data serve to provide the production engineer with a starting point for setting machining conditions for a production operation. Application of the machinability data to production operations must be done judiciously to obtain optimum performance. A careful analysis of the work material, the operating characteristics of the machine tool and the performance of the cutting tool must be made in every case. Through this approach significant cost savings can be achieved on production machining operations.—**Reported by W. F. Kaufman for St. Louis.**

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129. Effect of Deformation Prior to Transformation on the Mechanical Properties of 4340 Steel, by Eric B. Kula and Joseph M. Dhosi, Ordnance Corps, Watertown Arsenal, Watertown, Mass.

A method of hardening has been investigated which can lead to a higher strength and an improvement in impact properties. This consists of deforming the steel in the austenitic state and quenching it to form martensite before recrystallization occurs.

Rolling of 4340 steel at 1550 and 1000° F. was investigated. A 10% increase in yield strength, from 230,000 to 255,000 psi., no change in tensile strength, and an improvement in impact properties were noted after rolling to a 72% reduction at 1550 and tempering at 450° F. Similar deformation at 1000° F. increased the yield strength 19% to 280,000 psi. and the tensile strength 13% to 310,000 psi. Reasons for the improvement and practical applications of the results are discussed briefly.

130. The Effect of Trace Elements on the Tensile, Electrical Resistance and Recrystallization Properties of High-Purity Nickel, by K. M. Olsen, Bell Telephone Laboratories, Inc., Murray Hill, N. J.

The effects of small quantities of magnesium, aluminum, manganese, silicon, boron, carbon, zirconium, cobalt, tungsten and titanium on the electrical resistance, tensile and recrystallization properties of high-purity nickel have been determined. Measurements were made on 0.025 in. diameter wire prepared from controlled atmosphere melted and cast ingots. This study is part of a comprehensive investigation of the influence of these minor constituents on the emission characteristics and life of oxide-coated nickel cathode structure used in vacuum tubes.

On an atomic percent basis, additions of tungsten, titanium and silicon had the greatest effect on the resistivity of nickel, while zirconium and carbon had the greatest influence on tensile strength.

The most pronounced influence on recrystallization was found to be associated with additions of elements which had a much larger atom size than that of nickel. The greatest retardation of recrystallization resulted from the addition of 0.1% by weight of zirconium (6 atoms per 10,000). This addition produced an approximate 400° C. increase in recrystallization temperature over that of pure nickel.

On Furnace Atmospheres Panel in Boston

Shown at a Meeting in Boston During Which a Panel Discussion on "Furnace Atmospheres" Was Held Are, From Left: O. E. Cullen, Suface Combustion Corp., Who Spoke on Exothermic and Endothermic Generators; C. A. Mueller, Lindberg Engineering Co., Who Described Ammonia, Hydrogen and Nitrogen; W. F. Collins, past chairman; and R. A. Pomfret, chairman

Speakers: O. E. Cullen
and C. A. Mueller

The **Boston Chapter** held a panel meeting on "Furnace Atmospheres" with Orville E. Cullen, chief metallurgist and manager of research and development, Surface Combustion Corp., and Charles A. Mueller, chief engineer, Gas Process Division, Lindberg Engineering Co., as panelists.

Mr. Cullen spoke on exothermic and endothermic generators and the application of the gases produced. Exothermic gas is widely used for protective atmospheres. It makes use of combusted mixtures of air and hydrocarbon fuels. The combustion is self-sustaining and gives off heat. A lean or rich exothermic gas can be formed, depending upon the degree of combustion. Extensive use is made of exothermic gas for bright annealing and for inert atmospheres and there are many other applications for this type gas. A flow diagram was shown illustrating a typical exothermic gas producer. Exothermic gas may be either reducing or oxidizing to various materials, depending upon the relative ratios of CO to CO_2 and H_2 to H_2O.

Endothermic gas does not have sufficient heat and an external heating source together with a catalyst must be used. It contains high amounts of carbon monoxide and hydrogen, and very little, if any, carbon dioxide. It is reducing to most common metals and is generally used for its carburizing potential. The endothermic atmosphere can be used for carbon restoration and is widely used in batch-type and continuous furnaces. In using the endothermic atmosphere, the dewpoint can be carefully controlled, depending upon the conditions for which it will be used. By varying air-gas ratio, the dewpoint can be varied and this, in turn, will vary the carbon potential.

Mr. Mueller talked about ammonia, hydrogen and nitrogen. He explained the process of dissociation of ammonia and discussed nitriding and carbonitriding processes. He pointed out that dissociated ammonia can be used cheaply in bell-type furnaces because it is a mixture of 75% hydrogen and 25% nitrogen and has the same equivalent properties as pure dry hydrogen. It is free of oxygen and relatively free of water vapor.

Pure, dry hydrogen is frequently used for bright hardening, annealing and special brazing operations. Generally speaking, hydrogen can be successfully used to prevent decarburization but its success is affected by extraneous factors.

Nitrogen is sometimes used for a protective atmosphere because it is inert. However, moisture and infiltration of other gases into a nitrogen atmosphere must be avoided.—**Reported by Stephen G. Demirjian for Boston.**

Metal Show Dates Revised

Some months ago, as a result of conflicting dates with a large national meeting in Philadelphia, a revised schedule for the National Metal Congress and Exposition was established. This new schedule, now arranged on a long-term basis, explains the early return of the Metal Show to Chicago in 1959. As a result of these readjustments in schedule, A.S.M. headquarters in Chicago will be at the Sherman Hotel, with the Exposition held, as in the past, at the International Amphitheatre.

Future Metal Shows will be held in the following cities:

1960—Philadelphia
1961—Detroit
1962—Chicago
1963—Cleveland

Course on Metallurgy

The Eastern New York Chapter presented a series of educational lectures on the "Elements of Metallurgy", with John J. McCarthy, Rensselaer Polytechnical Institute, as lecturer.

The course covered methods of obtaining metals and the general nature of metals. Main emphasis was on physical metallurgy, including microstructure, crystal structure, freezing of metals, alloying, phase diagrams, deformation and fracture, diffusion and heat treatment. Application of these principles to specific metallurgical fields was stressed.

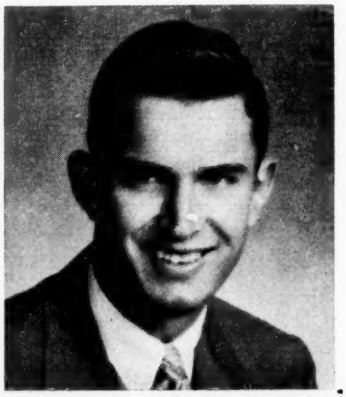
Trustee Covers Mechanical Behavior of Materials

Speaker: E. E. Stansbury
University of Tennessee

At **Chattanooga Chapters'** National Officers' Night a talk on "Metallurgical Factors in Mechanical Behavior of Metals" was given by E. E. Stansbury, professor of metallurgical engineering, University of Tennessee, and national trustee A.S.M.

Dr. Stansbury stated that alloying elements in steel have an effect on heat treatment to produce a desired condition. Using diagrams, he showed how the presence of elements such as chromium change the heating time and cooling conditions to produce a desired condition where the absence of the element would require a different set of conditions or make it impossible to attain the condition. He also pointed out that alloying elements have an effect on physical properties of a given substance.—**Reported by J. H. McMinn for Chattanooga Chapter.**

Chosen for RPI Scholarship



Laurence A. Jackman, a native of Brockton, Mass., now living in Whitinsville, has been chosen by the Metallurgy Faculty of Rensselaer Polytechnic Institute as the 1958-59 winner of the A.S.M. Foundation $500 Scholarship. Larry is active in sports at Rensselaer and a student leader in community affairs where he lives with his parents, Mr. and Mrs. Arthur Jackman.

Outlines Developments In Tool and Die Steels

Speaker: Stewart G. Fletcher

Latrobe Steel Co.

Stewart G. Fletcher, vice-president, metallurgy, Latrobe Steel Co., spoke in **Minnesota** on "Modern Developments in Tool and Die Steels".

The talk covered the innovations in four areas of toolsteel engineering—improved composition, improved manufacturing techniques, heat treating and the use of toolsteels in new applications.

Few revolutionary advances have been made in the toolsteel industry since the introduction of high-speed toolsteel. Advances that have been made have been in the form of improvements of existing compositions and techniques, such as the addition of sulphur and vanadium to toolsteel. Sulphur gives better machinability and, because the sulphides are well dispersed, does not affect properties appreciably. Vanadium forms a very hard carbide in toolsteel, giving better wear properties.

Improvements in manufacturing techniques have been aimed at producing a higher quality, more uniform product. Instrumentation has been introduced into the toolsteel industry in an attempt to better control conditions and alloy contents. An example is the use of the direct reading spectrometer which will analyze a sample of a melt in one minute. By improving melting and pouring techniques carbide and alloy segregation has been controlled. Instrumentation in the form of ultrasonic testing has made it possible to inspect internally 100% of the toolsteel produced.

The advances in heat treating have resulted from increased knowledge of the effects of heat treating and better equipment. Size changes in toolsteel due to quenching and tempering are understood and can be compensated for by the heat treater. Better equipment has resulted in more accurate temperature and atmosphere control.

Because high-speed steels retain their properties at elevated temperatures they are finding many new uses. The aircraft industry is presently using toolsteel in bearings and hydraulic pumps of jet engines to combat the effects of temperature and wear. Aircraft flying at three times the speed of sound encounter temperatures which can only be met with steels with high properties at elevated temperatures for use as structural members. At present even conventionally made toolsteels cannot meet the demands of these conditions and such processes as vacuum melting and consumable electrode refining are being investigated. These processes produce an even higher quality product while permitting the addition of reactive metals such as titanium, zirconium and columbium. **—Reported by Bob Sundahl for Minnesota Chapter.**

Describes Metal Forming by Explosives

Shown at a Meeting of Pittsburgh Chapter Are, From Left: Richard H. Lambert, Technical Chairman; John A. Haynes, National Northern Corp., Who Spoke on "Metal Forming by Explosives"; and Chairman S. G. Fletcher

Speaker: John A. Haynes

National Northern Corp.

John A. Haynes, manager, sales department, National Northern Corp., spoke at a meeting of the **Pittsburgh Chapter** on "Metal Forming by Explosives". He stated that, although the technique of explosive forming is considered a relatively new process, patents were issued in England and Germany before the turn of the century.

Mr. Haynes described in detail the requirements for explosive forming which include a die, normally steel (plastics and concrete have been used), a shaped explosive charge and a medium surrounding the charge to transmit the energy to the metal being formed. The advantages of the process are the high elongations realized (70% for AISI 1020 steel) and the absence of "spring-back" after forming. An equation has been developed which can be used to predict the plasticity of a particular family of metals based on an experimentally determined constant.

A 20-min. movie on the process was presented with comment by the speaker on the type of dies utilized, explosives, energy transmission medium and metal being formed. The process is capable of producing forgings, welding, bonding, shearing and punching. Preliminary work has been done which indicates that explosion extruding is a feasible process.

Mr. Haynes concluded by stating that explosive forming may now be considered a practical process for producing formed metal parts.—**Reported by D. W. Gunther for Pittsburgh Chapter.**

Lorig Meets Muncie Committee Members

A.S.M. President C. H. Lorig, Technical Director, Battelle Memorial Institute, Spoke on "Selection of Materials in This Changing World" at a Meeting in Muncie. Shown at a luncheon preceding the meeting are, from left: Dr. Lorig, J. Dunlap McNair, Thomas Wescott, Donald Waid, Robert McCreery, chairman, Robert Peters, John Buxton, secretary-treasurer, Melvin Altmark, Ted Hollingsworth, William Charlesworth and W. Grunden

Chicago-Western Series Features Tours

Shown at the Educational Meeting Held at Fansteel Metallurgical Corp. by the Chicago-Western Chapter Are, From Left: J. H. Schmidt, Jos. T. Ryerson & Son, Inc.; R. W. Hanzel, Chairman; N. K. Koebel, Educational Committee; H. W. Highriter, Vice-President, Fansteel; P. K. Zimmerman, Vice-Chairman; D. T. Taylor, Technical Director, Metals and Fabrication Division, Fansteel. In the background is a tensile strength testing machine in the metallurgical laboratory at Fansteel Metallurgical Corp.

About 100 members of the **Chicago-Western Chapter** have completed a successful educational program on the "Manufacture and Processing of Nonferrous Metals". The program was arranged so that a plant tour would follow the lecture given on the subject the preceding week.

The first lecture was given by R. P. Kytle, Jr., director of industrial products, Reynolds Metals Co., on the manufacture, processing and application of aluminum. The following week, a plant tour was made of the Reynolds, McCook, Ill., plate and sheet mill to view operations of melting, casting ingot, rolling, stretcher leveling and heat treating operations on aluminum alloys.

The next session was held at the Aluminum Co. of America, Bellwood, Ill., die casting and machining plant. Lectures were given by Alcoa's technical staff on the fundamentals of die casting, die casting problems, die casting alloys and machining, plating and finishing operations. A plant tour to view the die casting machines in operation followed the lecture.

G. E. Doremus, technical director, American Brass Co., Kenosha, Wis., presented the third lecture on the manufacture, processing and applications of copper and copper alloys. The following week an inspection tour was made at the American Brass Co., Kenosha, Wis., to view operations of milling, casting ingot, extending rod, tube drawing, wire drawing and rolling of sheet and plate of various copper alloys.

The final lecture was given by H. W. Highriter, vice-president and director, development department, Metal Products Division, Fansteel Metallurgical Corp., North Chicago, on the manufacture, processing and application of refractory metals. This lecture was followed by an inspection tour of Fansteel to view ore treatment, chemical processing, powder metallurgy, reduction, sintering, rolling and fabrication of the refractory metals tungsten, molybdenum and tantalum.—**Reported by N. K. Koebel for Chicago-Western.**

Describes Sejournet Process at Tri-City

Speaker: J. A. Stevenson
H. M. Harper Co.

Members of the **Tri-City Chapter** heard John A. Stevenson, technical sales manager, H. M. Harper Co., speak on the "Sejournet Extrusion Process for Steel".

Mr. Stevenson placed emphasis on the Sejournet process as a factor in "the futuristic growth" of his company, which is primarily a producer of nuts, bolts and screws made from stainless steels. The process, patented in France in the early 1940's, is based on the use of glass as a lubricant. The discussion also covered problems of die life, extrusion temperatures and extrusion rates.

As a supplement to his subject, Mr. Stevenson showed a film which illustrated the process from billet production to removal of glass from the final extruded product. Other items of interest were samples of various shapes, sizes and steel types which he brought with him.

Stress was laid upon the fact that potentialities of steel extrusion have not begun to be realized, but that the Sejournet process will aid in realizing that potentiality in American industry. —**Reported by B. G. Allen for Tri-City.**

Washington Holds Social

The **Washington Chapter** inaugurated the current season with its annual "Quench and Draw Party", held at the Dodge Hotel. The party was well attended and enjoyed as usual by all guests present.

Jominy Speaks at Warren Meeting

Walter E. Jominy, National Secretary A.S.M., Discussed "Metallic Wear" at a Meeting of the Warren Chapter. He also covered latest A.S.M. headquarters' activities. Shown are, from left, front: C. H. Weimer, chairman; and Dr. Jominy. Back row, from left: Eugene Heffner, educational committee; J. O. Williams, membership committee; Theodore A. Hart, secretary-treasurer; and Anthony J. Shield, vice-chairman of the chapter

Gives Series on Metallurgical Testing

"Metallurgical Testing" Was the Subject of a Series of Educational Lectures Presented Recently by the Peoria Chapter. Shown at the first meeting are, from left: G. K. Manning, Battelle Memorial Institute; T. H. Spencer, Peoria plant quality control manager, A. L. Jerome, plant metallurgist, D. J. Wright, quality control manager, and D. S. Gould, metallurgical development supervisor, all from the Caterpillar Tractor Co.

The **Peoria Chapter** has recently completed a series of lectures on the subject "Metallurgical Testing".

Topic of the first meeting was "Hardenability" presented by George K. Manning, chief, Metallurgical Engineering Division, Battelle Memorial Institute.

Mr. Manning first reviewed the history of hardenability tests and discussed those tests now in use. Isothermal charts and hardenability tables were used to illustrate the effect of such variables as cooling rate on hardenability.

"Ultrasonic Testing" was covered by R. B. Neeley and R. D. Albertson, sales engineers, Sperry Products, Inc. A movie was presented dealing with principles of ultrasonic testing, and use of the reflectoscope was demonstrated. Practical applications of the reflectoscope were also discussed.

R. H. Frazier, supervisor, tubular research, Youngstown Sheet and Tube Co., spoke on "Impact Testing". He discussed various impact specimens and tests now in use and the variables affecting impact strength and transition temperatures. Origin of brittle ship failures was also covered.

"Metallography", topic of the final lecture, was presented by Robert W. Bohl, metallurgical engineering department, University of Illinois. Dr. Bohl reviewed the variables affecting grain size and discussed the effect of grain size and phase distribution on the physical properties of metals. A series of slides was shown which demonstrated the value of metallography in determining the origin of failures. — **Reported by Ronald B. Diamond for Peoria.**

Worcester Hears National President

At a Meeting Held by Worcester Chapter Are, From Left: M. L. Price, Worcester Polytechnic Institute; Leonard L. Krasnow, Chairman; C. H. Lorig, National President A.S.M., Who Talked on "Materials for This Changing World"; and H. J. Holmes, Technical Chairman of the Meeting

Electron Microscope Is Defined as Tool at Purdue

Speaker: Stuart T. Ross

Chrysler Corp.

Stuart T. Ross, managing engineer, metallurgical research department, Chrysler Corp., spoke on "The Electron Microscope as a Metallurgical Tool" at a meeting at **Purdue.**

Dr. Ross opened with a historical resume of the cooperative research activities being conducted in electron metallography. This relatively new endeavor was born of necessity since controversial concepts of metallic structures were not being resolved by ordinary optical metallography.

The electron microscope is no longer a mystery but an indispensable tool, not only in research laboratories but in many control laboratories. It is not a replacement for the optical microscope but is used to complement optical studies. The interpretation of structural features obtained in electron microscopy is quite dependent on the optical studies, for the normal range of electronic magnification is 15,000 to 30,000 diameters and, as a result, only very small areas are examined.

The mechanical operation of the electron microscope is similar in some respects to the optical—an electron source is used instead of visible light, and magnetic field coils are used to collimate and "focus" instead of optical lenses. Specimen preparation is nearly the same although thin surface replicas must be made since electron beams do not reflect as does visible light.

Slides of electron micrographs were used to illustrate current research problems involving hardening and tempering in commercial steels. Deviations from a linear correlation between hardness and torsional yield strength, denoted as data instability, at high hardness levels were investigated. Using the high magnifications available carbide films along martensitic plate boundaries were found to be present in tempered martensite at the hardness levels where data instability was observed. Such films were absent in austempered samples, a fact which correlated with the observation that these samples revealed no data instability.

The electron transmission technique is one of the latest developments in this field and is important to research in substructure studies. Dislocations, lattice defects and twin boundaries are clearly revealed in the micrographs produced by this technique.—**Reported by J. D. Clyne for Purdue.**

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Describes Programming in Rolling Mills at Calumet

Speaker: R. E. Bodman
General Electric Co.

R. E. Bodman, application engineer, General Electric Co., presented a talk on "Automatic Programming of Rolling Mills" at **Calumet.**

A new terminology is invading the steel industry with the installation of six program-controlled rolling mills in the Chicago district. Such phases as card readers, code converters, comparators, error amplifiers and null sensors are a part of this new technology that is leading to increased productivity, lower operating and maintenance costs and improved quality of product. These goals are being accomplished through punched card programming of rolling mill control.

Increased utilization of blooming and breakdown mills has been necessitated by expanded, higher speed finishing facilities. Since approximately 50 to 75% of the operating time of such mills is consumed by manipulating and transferring the slab, reversing the mill and operating the screwdowns, it is logical that program control should be applied to these functions to minimize time loss and error due to human perception and reaction.

Gage control of 5000 to 6000 fpm. cold strip mill product is being achieved by regulating gage thickness from the first stand by screw control and controlling the speed of the finishing stand. Punched cards, tape and digital dial controls are used in programming gage settings, recording coil identification, turn identification, time, weight and footage of on and off gage products.

Automatic gage control for the finishing train of a hot strip mill is a complex problem that, to date, has lagged behind cold mill control. Three principal factors causing deviation are loss of tension at front and tail ends of the strip, variations in incoming temperature and variations in incoming thickness. Improved temperature sensing devices, speed control, radiation thickness gaging, roll force gages and programmed screwdown adjustment are contributing to eventual complete programming of hot strip mills.

Functional unit construction with nodular components, fault-finding circuits, cross-checks in programming and the use of transistors, static switching devices and other rugged equipment contribute to ease of maintenance and reduced downtime. Cooperation between mill builder, operating personnel and electrical manufacturer with full training of personnel are important aspects of programming.—**Reported by R. D. Engquist for Calumet.**

Presents First Alpha Sigma Mu Charter

R. H. Aborn, National Treasurer A.S.M., Presents the Alpha Sigma Mu Charter to C. Washburn, Chairman of the Student Group, Missouri School of Mines and Metallurgy. At left is Dean C. L. Wilson, at right is A. W. Schlechten, chairman of the department of metallurgical engineering

The first chapter charter of Alpha Sigma Mu, the National Metallurgical Honorary Fraternity, to be granted since this organization has been sponsored by A.S.M., was presented to the group at the Missouri School of Mines and Metallurgy on Dec. 3.

The presentation was made by R. H. Aborn, national treasurer A.S.M. and Alpha Sigma Mu and director of the Bain Laboratories for Fundamental Research, U. S. Steel Corp., at a banquet attended by active and honorary members. The charter was received by Charles Washburn, president of the new chapter and a reply was made by Dean Curtis L. Wilson, head of the school.

Alpha Sigma Mu was founded in 1932 at Michigan College of Mining and Technology for the purpose of honoring metallurgy students of high scholastic standing and alumni who have done outstanding work in the field of metallurgy. At the present time there are chapters located at Michigan College of Mining and Technology, University of Illinois, Virginia Polytechnical Institute, and now Missouri School of Mines.

The presentation banquet was attended by the 14 charter members of the local chapter, officers of A.S.M., the faculty of the metallurgy department, Dean Wilson and R. H. Aborn.

Technical Papers Invited for A.S.M. Transactions

The Transactions Committee of the A.S.M. is now receiving technical papers for consideration for publication in the Transactions of the Society and possible presentation before the next national meeting of the Society, to be held in Chicago, Nov. 2 to 6, 1959.

Many of the papers approved by the Committee will be scheduled for presentation on the technical program of the 41st National Metal Congress and Exposition.

Papers may be submitted any time up to Apr. 15, 1959, for consideration for presentation at this convention. The selection of approved papers for the convention technical program will be made in May 1959. Manuscripts may be submitted any time during the year and upon acceptance by the Transactions Committee will be processed immediately for preprinting. All papers accepted will be preprinted and made available to any members of the Society requesting them. However, the printing of an accepted paper does not necessarily infer that it will be presented at the convention. Reprinting of accepted papers is done quarterly; notification of their availability is published in *Metals Review*.

Manuscripts in triplicate, plus one set of unmounted photographs and original tracings, should be sent to the attention of Ray T. Bayless, assistant secretary, American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

Should it be your intention to submit a paper, please notify A.S.M. A copy of the booklet entitled "Suggestions to Authors in the Preparation of Technical Papers" will be gladly forwarded. This booklet may help considerably in the preparation of line drawings and illustrations.

Eastern New York Holds Welding Panel

A Panel Discussed "New Trends in Welding" at a Meeting of Eastern New York Chapter. Shown are, from left: John J. McCarthy, Rensselaer Polytechnic Institute, Robert M. Curran, General Electric Co., panelist; J. H. Westbrook, chairman; Mrs. C. B. Craver, treasurer; Warren F. Savage, Rensselaer, panelist; and A. Muller, Air Reduction Sales, panelist

A panel discussion on "New Trends in Welding" was held at a recent meeting of the **Eastern New York Chapter.**

Warren F. Savage, Rensselaer Polytechnic Institute, spoke on "New Ideas in Welding Research". He pointed out the continuing effort being made at Rensselaer to relate structure to properties of metals. The structure adjacent to arc welds is reproduced in laboratory specimens and subsequently tested. The apparatus enables a specimen to undergo a wide variety of cooling rates, heating rates, peak temperatures and temperature of fracture. Effect of cooling rates on the transformation temperature of steel is being investigated by means of a high speed dilatometer. Thermal fatigue is also being investigated.

Albert Muiler, Air Reduction Sales, discussed "Future Developments in Welding". He emphasized the trend towards the use of more intense heating methods in welding and noted the interest in plasma jets and the electronic torch.

Mr. Muller then outlined the history of welding and spoke about the newer welding methods, including ultrasonic and electron beam welding.

Robert M. Curran, General Electric Co., presented a talk on "Welding From the Consumer's Viewpoint". He stressed the importance of welding and its impact on product design and performance. Repair welding insures the production of sound castings.

The speaker also showed how the welding process must be scrutinized when the possibility of embrittlement or decarburization may occur in parts undergoing high-temperature, long-time operations. A question and answer period concluded the meeting. **—Reported by Louis Ianniello for Eastern New York.**

St. Louis Presents Course

St. Louis recently presented a well-qualified panel of authorities who spoke on "Toolsteel Selection".

After being held up for over 30 min. while late registrations were being processed, Robert K. Dunn, chief toolsteel metallurgist at the Sanderson-Halcomb Works, Crucible Steel Co., presented the first lecture of the series. Mr. Dunn discussed the terminology of toolsteels, the heat treatment of toolsteels and alloying elements in toolsteels with respect to their characteristics and uses.

Four subsequent lectures by J. Y. Reidel, Bethlehem Steel Co., R. H. Boettger, Columbia Tool Steel Co., George Schad, Carpenter Steel Co., and P. R. Borneman, Allegheny-Ludlum Steel Corp., covered how toolsteels differ, cost, machinability, hardenability, type of service and other factors which are involved in the application of toolsteels.

H. G. Johnstin, Vanadium Alloys Steel Co., conducted the final session which was devoted to a discussion of shop problems, particularly with respect to proper selection of toolsteels and the effect on the problems presented.—**Reported by W. F. Kaufman for St. Louis.**

Talks on Properties of Ceramics

Earl R. Parker, Metallurgical Department, University of California, Presented a Talk Entitled "Physical Properties of Ceramics" at a Meeting in Chicago. Shown are, from left: David W. Levinson, technical chairman of the meeting; Dr. Parker; and William Wilson, chapter chairman

Speaker: E. R. Parker

University of California

Earl R. Parker, department of metallurgy, University of California, presented a talk on the "Physical Properties of Ceramics" at a meeting of **Chicago Chapter.**

Dr. Parker discussed the ductile behavior of apparently brittle materials which owe this embrittlement to environment. His interest in ceramics developed from his early work on the high-temperature properties of metals. Since metals seemed to have close physical similarities with ceramics, the latter offered a better means to study the characteristics that explain what makes a metal brittle or ductile, as the case may be.

The inherent ductility of materials like rock salt, silver chloride, ice and others was explained and illustrated. Dr. Parker stated that surface reaction phenomena explained embrittlement.

Good ductility possibilities for ceramics seem to rest with extremely fine grain size on the order of 10 to 20 microns and with high purity.

Many members and guests engaged in a lively discussion to close this interesting meeting. — **Reported by I. R. Wood for Chicago.**

Precision Castings Topic at Dayton

W. O. Sweeny, Arwood Precision Casting Corp., Spoke on "Precision Castings" at a Meeting of Dayton Chapter. Shown are, from left: Walter Ridd, chairman; Mr. Sweeny; and Jack Copeland, local A.S.T.E. chairman

Speaker: W. O. Sweeny
Arwood Precision Casting Corp.

Members of the **Dayton Chapter** were guests of the local chapter of the American Society of Tool Engineers at the annual joint meeting held recently. W. O. Sweeny, vice-president, Arwood Precision Casting Corp., presented a talk entitled "Precision Castings".

Mr. Sweeny referred to this casting technique as "investment", rather than "precision" casting. Surface quality is much better than other casting methods and tolerances are in the order of ±0.005 in. per in. Mr. Sweeny cautioned against specifying investment castings when the limitations of the process are not fully understood. As an example, he told of a manufacturer who wanted a part cast that contained a slot within a few thousandths of an inch tolerance. The foundry decided they could not make these castings economically until it was discovered that the purpose of the slot was that it should be filled with plastic. In this example, the tolerances specified by the customer were worthless, and more realistic tolerances would have been in the order of ±1/32 in.

In some cases, investment castings can be used to advantage when only a few areas on the casting require close tolerances. A secondary finishing or machining operation then will bring the required areas into tolerance.

Metallurgical properties of investment castings are similar to wrought parts made of the same material except for somewhat lower ductility. Depending upon the shape of the casting and the gating technique, the castings may contain a little microshrinkage.

Insistence upon no porosity or microshrinkage (X-ray inspection), or close dimensional tolerances where not required by the end use raises the price of the casting out of proportion because of the unnecessarily high rejection rate.

Mr. Sweeny listed some factors to consider if contemplating using investment castings.

(1) Small size—a general rule is that only castings small enough to hold in your hand are economic.

(2) Use only for an alloy, a shape, or quantity that cannot be obtained by other means. Investment castings cannot compete with screw machine parts, punchings or die castings.

(3) Keep tolerances realistic. Remember, it is a casting.—**Reported by D. M. Ashfal for Dayton.**

Use of Metallographic Tools Subject at Buffalo

Speaker: W. D. Forgeng
Electro Metallurgical Co.

W. D. Forgeng, chief metallographer, Metals Research Laboratories, Electro Metallurgical Co., discussed how metallographic tools can be used to determine how particles of matter are located with respect to each other in a microstructure.

By a review of metallographic equipment and illustrating the uses of each type, Dr. Forgeng pointed out that every problem in metallography cannot be solved by using the same technique and equipment. For example, dark field illumination makes material appear as it would in natural daylight, therefore, dark field illumination is excellent for the examination of nonmetallic materials or inclusions.

Man's ability to retain in memory minute variations in color shading is very limited. For this reason the color recording of microstructures should be considered in those cases where results are to be analyzed on a color shading basis. Many cases exist in the history of his laboratory where the leisurely study of a color print, long after the original optical viewing had rejected variations in structure, revealed details that were completely missed in the original study.

Polarized light sometimes reveals original grain size and therefore is an excellent means of obtaining the true grain size of a material. Preferred orientation, inclusion and internal strains are readily studied under this illumination. The phase contrast microscope is a positive way to show differences in level of a surface. The study of "hot" specimens in the visible, infra-red and ultraviolet regions is best accomplished using reflecting objectives.

The electron microscope has made it possible for the metallographer to resolve structures not capable of resolution through optical methods. In general the resolving power of a good electron microscope is at least 100 times that of an optical microscope. Some of the original loss in resolution resulting from the use of plastic replicas has now been overcome by vapor-deposited films of such materials as carbon.

In concluding his talk, which was illustrated by a collection of remarkable photomicrographs, Dr. Forgeng showed the detailed resolution that he has obtained at 100,000 magnification on a sample of pearlite.—**Reported by G. F. Kappelt for Buffalo.**

Albuquerque Joins Student Chapter at Socorro Meeting

Twenty-four members of the **Albuquerque Chapter** drove to Socorro, New Mexico, to join the Student Chapter of the New Mexico Institute of Mining and Technology for a special technical program. The general topic was "Extractive and Physical Metallurgy of Copper", an appropriate subject since the southwestern U. S. is one of the four areas producing 80% of the world's supply of copper.

The speakers and their subjects were:

Dr. Weber, New Mexico Bureau of Mines—Geology and Mineralogy of Copper; Dr. Bertholf, New Mexico Bureau of Mines—Mining of Copper; Mr. Latvalla, New Mexico Institute of Mining and Technology—Mineral Dressing of Copper Ores; Mr. Thompson, New Mexico Bureau of Mines—Smelting of Copper Ore; and Mr. Wilson of the Albuquerque Chapter—Physical Metallurgy of Copper.

The evening dinner session was followed by a semitechnical talk by Dean Wise of the Albuquerque Chapter, on "The Mineralogy of a Gall Stone, With Elaborations on the Rocks in Our Lives". —**Reported by Gerrit J. Hof for Albuquerque.**

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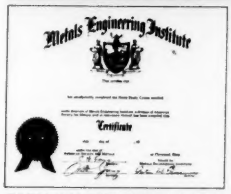

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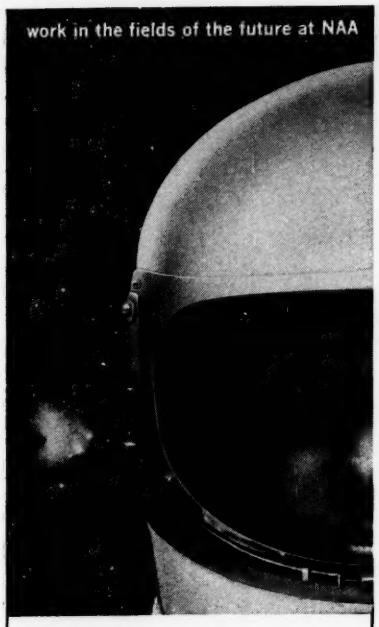

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ACADEMIC POSITION: Metallurgist or metallurgical engineer, preferably with experience in nuclear reactor materials, to teach and supervise graduate research in physical metallurgy and metallography. Excellent opportunity for research and professional development in progressive engineering school with extensive programs in metallurgical and nuclear engineering. Salary and rank commensurate with qualifications. Box 1-95.

METALLURGIST: GS-12, $8810 per year. Interested applicants may apply at any Post Office for applications, Standard Form 57, or for information as to where such forms may be obtained. Completed application should be mailed to the Board of U. S. Civil Service Examiners, Naval Air Station, Pensacola, Fla.

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UNIVERSITY POSITIONS: The staff of a new school of metallurgy and metallurgical engineering has two openings at the assistant professor rank. Ph.D. or equivalent required. Specialization in either extractive or physical metallurgy. Teaching duties include both undergraduate and graduate courses. Research interest is essential and facilities are extensive, including a one-megawatt nuclear reactor. Hamilton is the centre of Canada's steel and heavy fabrication industries. Write: Chairman, Dept. of Metallurgy and Metallurgical Engineering, McMaster University, Hamilton, Ont., Canada.

POSITIONS WANTED

MATERIALS ENGINEER: With M.Sc. degree in metallurgy and over ten years broad experience in alloy research, process development and fabrication of engine and reactor components. Emphasis has followed metal joining and stainless steel processing for high-temperature service. Responsibilities have included laboratory supervision, design consultation, group leadership and project engineering. Box 1-5.

METALLURGIST: B.S. degree, 19 years experience, including supervision in research, development, process control and customer service. Extensive background in diversified mechanical metallurgy, materials application, processing and quality control. Desires supervisory position in development or process control metallurgy with progressive organization. Prefers northeast; minimum salary $11,000. Box 1-10.

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PLANT MANAGER OR EXECUTIVE ASSISTANT: To top-level officer. Young, proven ability, hard worker, metallurgical engineering degree and master's degree in business administration. Currently plant manager in glass fiber plant, previously assistant to chairman of metal products company. Desires to locate in metropolitan area, New York preferred. Married. Excellent health. Box 1-15.

METALLURGICAL ENGINEER: M.S. degree plus advanced studies, family, age 31. Five years experience in development and application of brazing alloys, high-temperature alloys and magnetic materials. Three years research and development work on oriented soft magnetic alloys. Several publications and patent applications. Desire supervisory position and increased responsibilities in technical area. Box 1-20.

HEAT TREATER: Two years schooling in metallurgy and heat treatment of steel. Age 23, married, veteran. Three years practical experience in setting up and operating newest heat treating equipment. Will relocate Midwest area. Send replies directly to: Harold Thiess, 1235 S. 89th St., Milwaukee, Wis.

METALLURGICAL ENGINEER: Veteran, 1949 graduate, married, age 36. Six years experience in design and operation of electric-arc furnaces, including titanium melting and casting and two years with leading foundry. Successful introduction of CO_2 process to mass production of cores. Desires greater responsibility. Minimum salary $10,000. Box 1-25.

METALLURGIST: B.S. degree in metallurgical engineering, age 29, married, veteran. Four years experience in materials research and development. Post-graduate study in physical metallurgy and alloy steels. Desire technical sales or sales liaison position. Complete resume on request. Box 1-30.

METALLURGIST: B.S. degree, age 36, married, 13 years experience as technician, supervisor and group leader in aircraft manufacturers' engineering and quality control metallurgical and nondestructive testing laboratories. Resume on request. Box 1-35.

METALLURGICAL ENGINEER: Available for administrative position. Eleven years diversified background in applied research and development in the fields of nuclear metallurgy, refractory metals and cermets, nondestructive and destructive testing, metallography, fabrication, joining, cost analysis, patents. Proficient French and German, some Russian familiarity. Desires Metropolitan New York City area. Box 1-40.

SUPERVISING METALLURGIST: Experienced with high-temperature alloys, cast iron, steels, aluminum, titanium, zirconium. Knows research, development, troubleshooting. Over half decade experience in responsible supervisory positions plus previous top-notch engineering work. Mid-30's, M.S. degree, publications. A doer; not a dreamer. Small or medium-sized company preferred. Box 1-45.

STRESS AND MATERIALS ANALYST: M.S. degree in applied mechanics, Oak Ridge School of Reactor Technology graduate. Age 35, family. Six years experience in experimental stress analysis and materials research. Three years design experience in stress analysis of nuclear reactor components and related material problems. Desire challenging research position in stress analysis, plasticity and mechanical metallurgy. Box 1-50.

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METALLURGIST: B.S. degree, four and one-half years experience, two years in ore concentration; two and one-half years nonferrous fabrication and forming, metallography, mechanical testing, heat treatment; six months aircraft structures, materials qualifying and evaluating ferrous and nonferrous castings. Metallography, heat treatment, inspection, specifications and reports. Box 1-105.

METALLURGICAL ENGINEER: B.S. degree from Case Institute of Technology. Industrial experience in steel company. Age 37. Desires physical or production metallurgy field. Cleveland area. Box 1-110.

MECHANICAL METALLURGIST: With 20 years experience in practical plant metallurgy, including specification writing and inspection of materials and plant problems. General plant experience in machining, fabricating, heat treatment, selection of materials, corrosion, brazing and design. Experienced in carbon and alloy steels, stainless, nonferrous. Will relocate. Box 1-115.

INSPECTOR-EXPEDITER: Experienced in ASME code, X-ray, magnaflux inspection in aircraft, electronics and foundry work. Business college and Temple University graduate. Available immediately. Box 1-135.

METALLURGIST: B.S. in chemical engineering, age 42, married, two children. Eighteen years diversified experience in metallurgical field relating to ferrous and nonferrous investment and permanent mold casting, welding, heat treating, forming, forging, physical testing, metallographic X-ray in ferrous and nonferrous field, also fabrication problems and failure studies in fields of aircraft and ordnance and development work in investment (one coat) plating, anodizing and cleaning solutions. Box 1-140.

METALLURGICAL TECHNOLOGIST: Eighteen years metal treating and tool hardening experience, including past 12 years in present company in research and development on metallurgical chemicals, customer service on metal treating and salt bath problems. Activity being discontinued by company. Desires to remain in this field. Resume on request. Box 1-145.

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KAPL Stress Analysis Engineer Eric Johansson, discussing with other KAPL engineers the problem of flow-induced vibration in twisted-ribbon fuel elements. High coolant flow rate required for rapid heat removal from reactor core is one of many conditions affecting stress and deformation in naval nuclear reactors.

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Eric B. Johansson is one of approximately twenty Stress Analysis Engineers working on naval reactors at KAPL. Eric joined G.E. in 1951 following graduation from the California Institute of Technology and graduate study at UCLA. He has completed advanced study in engineering analysis as a graduate of G.E.'s Advanced Engineering Program and has taken additional graduate work at Rensselaer Institute of Technology under G.E.'s Tuition Refund Program.

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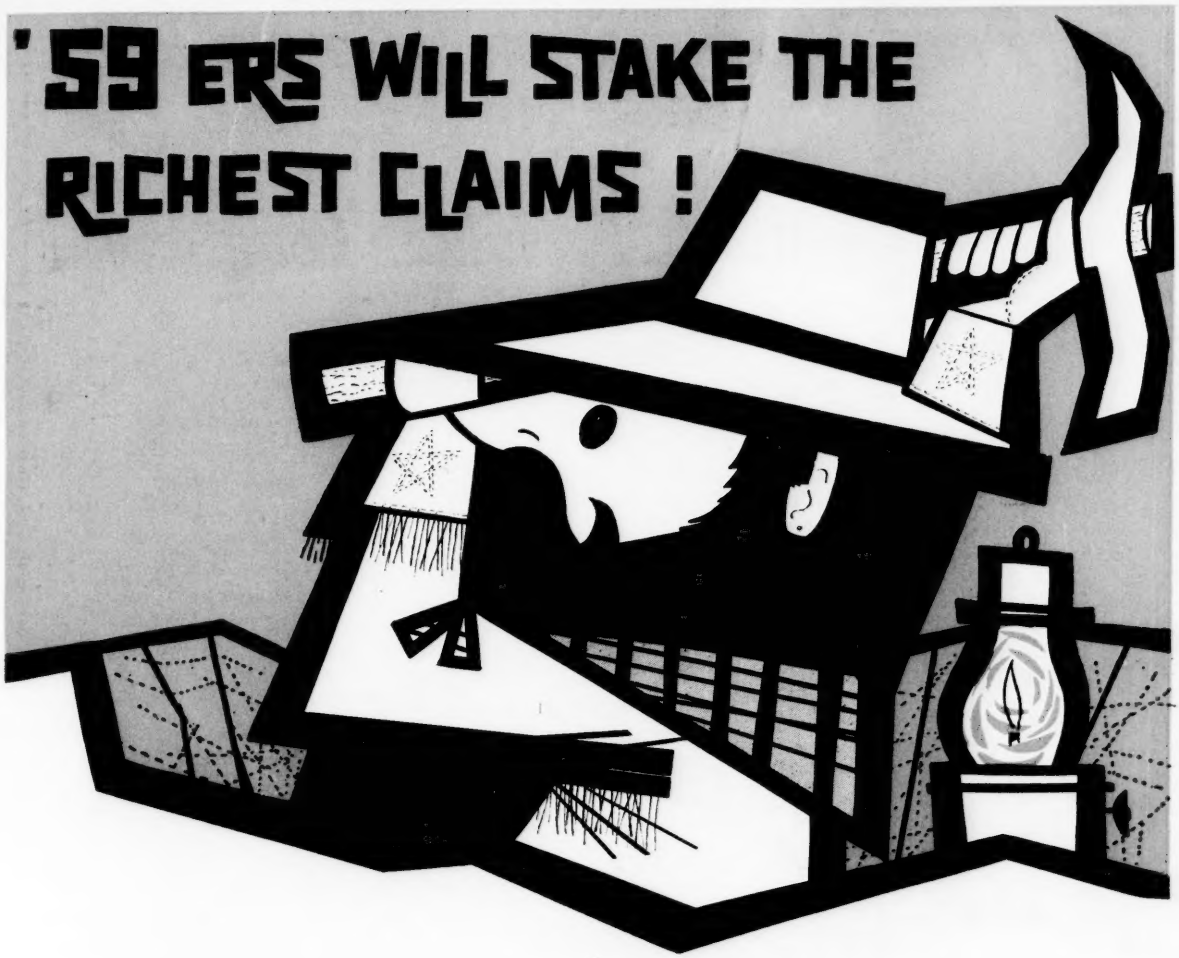

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